PLAN for

WATERSHED PROTECTION

and

FLOOD PREVENTION

WET WALNUT CREEK SUBWATERSHED NO. 5

SCOTT, LANE and NESS COUNTIES, KANSAS

ADDENDUM

WET WALNUT CREEK SUBWATERSHED NO. 5, KANSAS

This addendum was developed in accordance with phase-in procedures adopted by the Water Resources Council for level C plans for which field studies, analyses, and evaluations were completed as of October 25, 1973, and which have been formulated in accordance with Senate Document 97, as supplemented and amended. This plan was developed using 1974 prices and a 6 1/8 percent discount rate.

Section I of this addendum shows the benefit-cost ratio with and without secondary benefits using the price base and discount rate used in the plan.

Section II of this addendum displays an abbreviated alternative plan for Wet Walnut Creek Basin as a whole and was developed to emphasize environmental quality. This is a hypothetical plan, not to be installed, which presents information for comparison with the selected plan.

Section III of this addendum displays the effects of the selected plan for Wet Walnut Creek as evaluated for each of the separate accounts--national economic development, environmental quality, regional development, and social well-being.

SECTION I

of

ADDENDUM

for

WET WALNUT CREEK SUBWATERSHED NO. 5, KANSAS

This section shows the project costs, benefits, and benefit-cost ratio based on 6 1/8 percent interest rate.

1.	Average annual project costs are	$ 89,600
2.	Average annual project benefits without secondary benefits are	$ 96,100
3.	Average annual project benefits with secondary benefits are	$131,700
4.	The project benefit-cost ratio without secondary benefits is	1.1 to 1.0
5.	The project benefit-cost ratio with secondary benefits is	1.5 to 1.0

December 1975

SECTION II

of

ADDENDUM

for

WET WALNUT CREEK WATERSHED, KANSAS

Abbreviated Environmental Quality Plan

This Environmental Quality Plan must consider the Wet Walnut Creek basin as a whole. This plan is not restricted by limitations of any existing authority such as PL-566. Elements to be installed in certain portions of the basin are interrelated to elements and effects in other portions of the basin therefore necessitating basin-wide planning.

Environmental Problems

A. Natural Beauty and Human Enjoyment Area Problems

Shade tree population and quality in small towns within the basin have deteriorated in recent years due to Dutch Elm disease and improper management.

Open spaces for public use within the basin are non-existent. Recreational facilities within reasonable distance from the area are limited.

B. Biological Resource Problems

The existence and needs of rare and endangered species within the basin is little known.

Educational facilities focusing on the environment and preservation of natural resources are lacking in the basin.

The lack of diversity in large tract farming practices has adversely affected wildlife species.

Many acres of Type 1 and 2 wetlands in the western part of the basin are not utilized to their fullest potential for enhancement of wildlife.

The lack of ground water management within the basin has adversely affected stream aquatic habitat and riparian habitat.

C. Archeological and Historical Sites Problems

Archeological, historical, and unique architectural sites are unrecorded or destroyed because of the lack of information and communication between the local public and interested authorities.

D. Land, Water and Air Quality Problems

Unprotected sloping cropland and rangeland within the basin are subject to moderate or severe sheet erosion. The mainstem of Wet Walnut Creek is subject to heavy sedimentation. The average sediment yield for the basin is 108 acre-feet/year.

E. Need for Minimizing Conflicts in Land Use

Increased competition for land and water resources within the area make it important that resource problems be anticipated and that people have the authorities to deal with them. Short and long range comprehensive planning is needed to identify, protect, and enhance important values.

Component Needs

A. Areas of Natural Beauty and Human Enjoyment

A small town shade tree restoration program

Creation of open space public-use areas

B. Biological Resources

Full utilization of certain wetlands within the watershed should be accomplished.

Improve ground water management.

Improvement of fish and wildlife habitat.

Preserve existing riparian habitat.

C. Historical and Archeological Sites

Preservation of historical sites.

Preservation or notation of archeological sites that may be involved with future development areas.

D. Land, Water and Air Quality

Establish proper management systems on lands within the watershed.

E. Conflicts in Land Use

Establish a comprehensive land use plan.

Environmental Quality Plan Elements

A. Management, protection, enhancement, and creation of areas of natural beauty and human enjoyment.

1. Establish a shade tree development program for 13 rural towns.

   Installation by: Towns

   Technical Assistance by: Department of State and Extension Forestry

   Cost: $25,000; $2,000 OM&R

2. Establish 700 farmstead windbreaks and 160 acres of shelterbelts.

   Installation by: Landowners, Department of State and Extension Forestry, Agricultural Stabilization and Conservation Service

   Technical Assistance by: Department of State and Extension Forestry

   Cost: Included in land treatment ($45,000)

3. Rehabilitate 30 farmstead windbreaks.

   Installation by: Landowners (cost sharing program needed)

   Technical Assistance by: Department of State and Extension Forestry

   Cost: Included in land treatment ($2,000)

4. Establish 4 open space public use areas by purchasing and developing 1,737 acres. Establish within these areas 4 separate developments including a total of 322 acres in resevoirs, 644 acres of public use area, and 771 acres in buffer zones.

   Installation by: Kansas Forestry, Fish and Game Commission, Bureau of Outdoor Recreation, State Park and Resources Authority

   Technical Assistance by: Same as above

   Cost: $1,996,600 $40,100 OM&R

B. Management, preservation, and enhancement of especially valuable or outstanding biological resources or ecosystems.

1. Survey the occurrence of endangered and threatened species and their habitat needs.

   Installation by: Kansas Forestry, Fish and Game Commission

   Technical Assistance by: Kansas Forestry, Fish and Game Commission

   Cost: $9,000

2. Establish 3 outdoor classroom educational facilities encompassing a total of 60 acres.

   Installation by: School districts

   Technical Assistance by: Soil Conservation Service, Extension Forestry, Educational Institutions, Kansas Forestry, Fish and Game Commission, and Kansas Advisory Council on Environmental Education

   Cost: $18,000; $1,000 OM&R

3. Obtain easements on 3,150 acres of Type 1 and 2 wetlands in Subwatershed Nos. 4 and 5.

   Installation by: Kansas Forestry, Fish and Game Commission

   Technical Assistance by: Same as above

   Cost: $157,500

4. Increase land use diversity on 70,000 acres of cropland by using variable cropping patterns to provide increased edge effect and habitat diversity.

   Installation: Landowners

   Technical Assistance by: Kansas Forestry, Fish and Game Commission

   Cost: $35,000; $1,800 OM&R

5. Establish an extensive ground water management program including regulated withdrawl and a system of 44 recharge structures and 4 multipurpose (recharge - public use) strucutres to improve 265 miles of stream aquatic habitat.

   Installation by: Watershed district, Kansas Water Resources Board, Kansas Forestry, Fish and Game Commission, (Ground Water Management District needed)

   Technical Assistance by: Kansas Water Resources Board, Kansas Forestry, Fish and Game Commission USGS, Soil Conservation Service

   Cost: (48 sites) $11,872,100; $42,000 OM&R

6. Obtain easements on 11,000 acres of existing riparian habitat.

   Installation by: Kansas Forestry, Fish and Game Commission, Landowners (Cost sharing program needed)

   Technical Assistance by: Kansas Forestry, Fish and Game Commission

   Cost: $600,000

7. Protect 20 miles of existing stream aquatic habitat from sedimentation by removal of major obstructing log jams.

   Installation by: Landowners, Watershed district

   Technical Assistance by: Department of State and Extension Forestry, Kansas Forestry, Fish and Game Commission, Soil Conservation Service

   Cost: $15,000; $500 OM&R

C. Management, preservation, and enhancement of archeological and historical resources.

1. Survey construction and development sites to determine location, significance, and salvage requirements of archeological sites.

Installation by: National Park Service

Technical Assistance by: State Archeologist, National Park Service

Cost: $10,000

2. Identify and encourage preservation of unique architectural and historical sites.

Installation by: State and local historical societies

Technical Assistance by: State Historical Society

Cost: (not determined)

D. Quality considerations of water, land, and air resources.

1. Install land treatment measures and establish proper management systems to accomplish 100 percent watershed protection. Remaining needs include treatment of 257,000 acres of cropland, 124,500 acres of rangeland, 1700 acres of woodland, and 5000 acres other land.

Installation by: Landowners, Agricultural Conservation Program

Technical Assistance by: Soil Conservation Service, Department of State and Extension Forestry

Cost: $5,773,900; $863,000 OM&R

E. Avoid irreversible and irretrievable commitments of resources.

1. Establish a comprehensive plan including land and water use for each county within the basin.

Installation by: Cities and counties

Technical Assistance by: KDED

Cost: $60,000

Effects of Environmental Quality Plan

A. Areas of Natural Beauty and Human Enjoyment

The beauty of small towns within the watershed will be enhanced due to a shade tree restoration program. Rural area beauty and aesthetics will be improved through application of land treatment practices and windbreak and shelterbelt restoration or establishment. Flood plain area natural beauty will be maintained through preservation of the riparian habitat.

The creation of four public use areas will provide needed facilities for water-based recreation. The public developments will provide facilities for 53,100 sightseers, 19,200 picnickers, 41,900 fishermen, 1,800 boaters, and 14,000 campers, totalling 130,000 recreation days annually. Acquisition of areas associated with the developments will provide 966 acres for dams, reservoirs, and facilities and 771 acres of open space for public use. Creation of the developments will cause disruption in the tranquility of the rural environment by 130,000 recreation days annually.

B. Biological Resources

Terrestrial wildlife habitat in 40 acres of windbreaks will be improved due to rehabilitation. An additional 860 acres will be created through establishment of new windbreaks and shelterbelts.

Conservation land treatment on 388,200 acres of agriculture land and land use diversity on 70,000 acres of cropland will improve terrestrial wildlife habitat.

The existence and habitat needs of endangered and threatened species within the watershed will be identified.

The creation of 48 reservoirs will inundate 2,030 acres of terrestrial wildlife habitat and 51, 9, and 7 miles of ephemeral, intermittent, and perennial stream aquatic habitat respectively. The structures will create 2,030 acres of impounded aquatic habitat. Maintenance of flow will improve 142 and 123 miles of intermittent and perennial stream aquatic habitat respectively. Associated riparian habitat will also be improved.

Eleven thousand acres of riparian habitat and 3150 acres of Type 1 and 2 wetlands will be preserved.

The environmental education of young people within the area will be enhanced through use of outdoor classrooms.

C. Historical and Archeological Sites

Significant historical and archeological sites within the watershed would be identified.

D. Land, Water, and Air Quality

The application of land conserving practices on 257,000 acres of cropland, 124,500 acres of rangeland, 1,700 acres of woodland, and 5,000 acres of other land would bring 100 percent of the watershed under conservation treatment. Land treatment measures will reduce sediment yield from 108 acre feet per year to 78 acre feet per year. Land treatment plus 48 reservoirs will reduce sediment yield to 52 acre feet per year.

E. Irreversible and Irretrievable Commitments

Reservoirs will convert 1,419 acres of cropland; 2,766 acres of rangeland; and 51, 9, and 7 miles of ephermeral, intermittent, and perennial stream aquatic habitat respectively to reservoir pools, dams, spillways, and public use areas.

F. Conflicts in Land Use

Implemented land and water use planning for the watershed area will provide the authority to deal with conflicts in the use of the resources. Important environmental values will be recognized and protected through implementation of the plan.

SECTION III

of

ADDENDUM

for

WET WALNUT CREEK SUBWATERSHED NO. 5, KANSAS

Display of Selected Plan

in

National Economic Development Account

Regional Development Account

Social Well-Being Account

Environmental Quality Account

SELECTED PLAN

NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

WET WALNUT CREEK SUBWATERSHED NO. 5, KANSAS

Components	Measure of effects (average annual dollars)
Beneficial effects	
A. The value to users of increased outputs of goods and services	
1. Flood damage reduction	78,800
2. More intensive use	17,300
Total Beneficial Effects	96,100

Components	Measure of effects (average annual dollars)
Adverse effects	
A. The value of resources required for a plan	
1. Three single-purpose flood prevention reservoirs	
Project Installation[a/]	65,600
Project Administration[a/]	21,100
OM&R	2,900
Total Adverse Effects	89,600
Net Beneficial Effects	6,500

a/ Amortized for 100 years at 6 1/8 percent interest

SELECTED PLAN

REGIONAL DEVELOPMENT ACCOUNT

WET WALNUT CREEK SUBWATERSHED NO. 5, KANSAS

Components	Measure of effects (average annual dollars)	
	Region	Rest of Nation
A. Income		
Beneficial effects		
1. The value of increased output of goods and services to users residing in the region.		
a. Flood damage reduction	78,800	
b. More intensive use	17,300	
c. Secondary	35,600	
Total Beneficial Effects	131,700	

Components	Measure of effects (average annual dollars)	
	Region	Rest of Nation
A. Income		
Adverse effects		
1. The value of resources contributed from within the region to achieve the output		
a. Three single-purpose flood prevention reservoirs		
Project Installation[a/]	7,300	58,300
Project Administration[a/]	1,500	19,600
OM&R	2,900	
Total Adverse Effects	11,700	77,900
Net Beneficial Effects	120,000	

[a/] Amortized for 100 years at 6 1/8 percent interest

December 1975

SELECTED PLAN

REGIONAL DEVELOPMENT ACCOUNT

WET WALNUT CREEK SUBWATERSHED NO. 5, KANSAS

Components	Measure of effects	
	Region	Rest of Nation
B. Employment		
Beneficial effects		
1. Increase in the number and type of jobs		
a. Employment for project construction	22 man years semiskilled	
	7 man years unskilled	
b. Employment for project OM&R	.3 man year unskilled annually	
Total Beneficial Effects	.3 permanent unskilled jobs	
	22 semiskilled jobs for 1 year	
	7 unskilled jobs for 1 year	

Components	Measure of effects	
	Region	Rest of Nation
B. Employment		
Adverse effects		
1. Decrease in the number and type of jobs		
Total Adverse Effects	0	
Net Beneficial Effects	.3 permanent unskilled jobs	
	22 semiskilled jobs for 1 year	
	7 unskilled jobs for 1 year	

SELECTED PLAN

REGIONAL DEVELOPMENT ACCOUNT

WET WALNUT CREEK SUBWATERSHED NO. 5, KANSAS

Components	Measure of Effects	
	Region	Rest of Nation
C. Population Distribution		
Beneficial effects	Creates 22 semiskilled jobs for 1 year	
	Creates 7 unskilled jobs for 1 year	
	Creates .3 man year permanent employment annually	-
Adverse effects	-	-
D. Regional Economic Base and Stability		
Beneficial effects	Provides floodwater damage reduction for 54,317 acres	
	Creates .3 man year of unskilled employment annually.	
	Creates 22 short-term semiskilled and 7 short-term unskilled jobs.	

SELECTED PLAN

SOCIAL WELL-BEING ACCOUNT

WET WALNUT CREEK SUBWATERSHED NO. 5, KANSAS

Components	Measure of Effects
Beneficial and adverse effects	
A. Real income distribution	1. Create 29 man years low to medium income jobs for area residents during construction.
	2. Create .3 man year low to medium income employment annually in association with operation and maintenance of the works of improvement.
	3. Create regional income benefit distribution of $131,700. Family incomes are distributed: Under $3,000 — 12% $3,000 to $10,000 — 54% Over $10,000 — 34% It is assumed that benefits will be distributed at about the same percentages.
	4. Local costs to be borne by the watershed region total $11,700. Costs to be distributed by about the same ratio as benefits.
B. Life, health, and safety	1. Provide a sense of economic security and the psychological security associated with the abatement of a fear of flooding.

September 1975

SELECTED PLAN

ENVIRONMENTAL QUALITY ACCOUNT

WET WALNUT CREEK SUBWATERSHED NO. 5, KANSAS

Components	Measure of Effects
Beneficial and adverse effects	
A. Open and green space, lakes, and other areas of natural beauty	1. Create 3 floodwater retarding structures and 10 detention dams with a total of 463 surface acres on private land.
	2. Improve rural area beauty on 59,700 acres of agricultural land by the application of land treatment practices.
	3. Thirteen reservoir structures will increase landscape diversity.

SELECTED PLAN

ENVIRONMENTAL QUALITY ACCOUNT

WET WALNUT CREEK SUBWATERSHED NO. 5, KANSAS

Components	Measure of Effects
Beneficial and adverse effects	
B. The quality of water, land and air resources	1. Reduce flooding on 54,317 acres of flood plain land.
	2. Reduce floodwater damage 63 percent.
	3. Reduce delivery of sediment to the Arkansas River 22,400 tons annually.
	4. Reduce average annual erosion rate on cropland from 4.7 tons to 3.9 tons per acre.
	5. Reduce average annual erosion rate on rangeland from 1.3 tons to 1.1 tons per acre.
	6. Reduce average annual sediment in existing ponds 17 percent.
	7. Prolong stream flow following periods of above normal rainfall.

SELECTED PLAN

ENVIRONMENTAL QUALITY ACCOUNT

WET WALNUT CREEK SUBWATERSHED NO. 5, KANSAS

Components	Measure of Effects
Beneficial and adverse effects	
C. Archeological, historical, biological, and geological resources and selected ecological systems	1. Create water areas of 463 acres where waterfowl resting and feeding will occur.
	2. Improve wildlife habitat through establishment of enhancement measures adjacent to structural measures
	3. Wildlife habitat will be improved through application of land treatment practices on 59,700 acres.
	4. Create 463 acres of reservoir aquatic habitat.
	5. Inundate 463 acres of terrestrial wildlife habitat.
	6. Reduced use of 1,563 acres of terrestrial wildlife habitat during periodic inundation of reservoir flood pools.
	7. The use of 277 acres of terrestrial wildlife habitat to be occupied by dams and spillways would be temporarily interrupted.
	8. Inundate 3 miles of ephemeral and 3 miles of intermittent stream channel habitat.
	9. Prolong flows in intermittent streams.

SELECTED PLAN

ENVIRONMENTAL QUALITY ACCOUNT

WET WALNUT CREEK SUBWATERSHED NO. 5, KANSAS

Components	Measure of Effects
Beneficial and adverse effects	
D. Irreversible or irretrievable commitments	1. Commit 9 acres of cropland and 454 acres of rangeland to sediment pools.
	2. Commit 20 acres cropland and 257 acres rangeland to dams and spillways.
	3. Inundate 3 miles of ephemeral and 3 miles of intermittent stream.

WATERSHED PLAN AGREEMENT

between the

WET WALNUT CREEK WATERSHED JOINT DISTRICT NO. 58
Local Organization

LANE COUNTY CONSERVATION DISTRICT
Local Organization

NESS COUNTY CONSERVATION DISTRICT
Local Organization

SCOTT COUNTY CONSERVATION DISTRICT
Local Organization

(hereinafter referred to as the
Sponsoring Local Organizations)

State of Kansas

and the

Soil Conservation Service
United States Department of Agriculture

(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organizations for assistance in preparing a plan for works of improvement for the Wet Walnut Creek Subwatershed No. 5, State of Kansas, under the authority of the Watershed Protection and Flood Prevention Act (P.L. 566, 83d Congress; 68 Stat. 666) as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organizations and the Service a mutually satisfactory plan for works of improvement for

the Wet Walnut Creek Subwatershed No. 5, State of Kansas, hereinafter referred to as the watershed plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organizations and the Secretary of Agriculture, through the Service, hereby agree on the watershed plan, and further agree that the works of improvement as set forth in said plan can be installed in about five years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed plan:

1. The Sponsoring Local Organizations will acquire, with other than P.L. 566 funds, such land rights as will be needed in connection with the works of improvement. (Estimated Cost $118,400.)

2. The Sponsoring Local Organizations assure that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the Sponsoring Local Organizations and the Service as follows:

	Sponsoring Local Organizations (Percent)	Service (Percent)	Estimated Relocation Payment Costs 1/ (Dollars)
Relocation Payments	51.7	48.3	0

1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

3. The Sponsoring Local Organizations will acquire or provide assurances that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.

4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organizations and by the Service are as follows:

Works of Improvement	Sponsoring Local Organizations (Percent)	Service (Percent)	Estimated Construction Cost (Dollars)
3 Floodwater Retarding Structures	0	100	819,300

5. The percentages of the engineering costs to be borne by the Sponsoring Local Organizations and the Service are as follows:

Works of Improvement	Sponsoring Local Organizations (Percent)	Service (Percent)	Estimated Engineering Costs (Dollars)
3 Floodwater Retarding Structures	0	100	131,100

6. The Sponsoring Local Organizations and the Service will each bear the costs of Project Administration which it incurs, estimated to be $23,400 and $319,500 respectively.

7. The Sponsoring Local Organizations will obtain agreements from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.

8. The Sponsoring Local Organizations will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed plan.

9. The Sponsoring Local Organizations will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed. Detention dams will be operated and maintained by landowners at their own expense through agreements with the watershed district.

10. The Sponsoring Local Organizations will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the availability of appropriations for this purpose.

    A separate agreement will be entered into between the Service and the Sponsoring Local Organizations before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed plan may be amended or revised, and this agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organizations have failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local

Organizations in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organizations or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties. An amendment to incorporate changes affecting one specific structural measure may be made by mutual agreement between the Service and the sponsor(s) having specific responsibilities for the particular structural measure involved.

14. No member of or delegate to congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964, as amended, and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any activity receiving federal financial assistance.

16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

WET WALNUT CREEK WATERSHED JOINT DISTRICT NO. 58
Local Organization

By s/Lloyd E. West

Title President

Box 207, LaCrosse, Ks. 67548
Address Zip Code

Date May 13, 1976

The signing of this agreement was authorized by a resolution of the governing body of the WET WALNUT CREEK WATERSHED JOINT DISTRICT NO. 58
Local Organization

adopted at a meeting held on March 18, 1976

s/Lawrance Richards
Secretary, Local Organization

Box 207, LaCrosse, Ks. 67548
Address Zip Code

Date May 13, 1976

LANE COUNTY CONSERVATION DISTRICT
Local Organization

By s/Ernest Dean Kuehn

Title Chairman

Box 985, Dighton, Ks. 67839
Address Zip Code

Date May 13, 1976

The signing of this agreement was authorized by a resolution of the governing body of the LANE COUNTY CONSERVATION DISTRICT
Local Organization

adopted at a meeting held on May 11, 1976

s/Vicki Eitel
Secretary, Local Organization

Box 985, Dighton, Ks. 67839
Address Zip Code

Date May 13, 1976

NESS COUNTY CONSERVATION DISTRICT
Local Organization

By s/Keith E. Rider

Title Chairman

Box 439, Ness City, Ks. 67560
Address Zip Code

Date May 13, 1976

The signing of this agreement was authorized by a resolution of the governing body of the NESS COUNTY CONSERVATION DISTRICT
Local Organization

adopted at a meeting held on May 4, 1976

s/Kay Wasinger
Secretary, Local Organization

Box 439, Ness City, Ks. 67560
Address Zip Code

Date May 13, 1976

SCOTT COUNTY CONSERVATION DISTRICT
Local Organization

By s/Clyde Shinnerer

Title Chairman

Box 429, Scott City, Ks. 67871
Address Zip Code

Date May 13, 1976

The signing of this agreement was authorized by a resolution of the governing body of the SCOTT COUNTY CONSERVATION DISTRICT
Local Organization

adopted at a meeting held on April 13, 1976

s/Kathy Wessel
Secretary, Local Organization

Box 429, Scott City, Ks. 67871
Address Zip Code

Date May 13, 1976

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

s/Robert K. Griffin
State Conservationist

May 13, 1976
Date

WATERSHED PLAN

Wet Walnut Creek Subwatershed No. 5

Lane, Ness, and Scott Counties, Kansas

Prepared Under the Authority of the
Watershed Protection and Flood Prevention Act
(Public Law 566, 83d Congress; 68 Stat. 666) as amended

Prepared by

Lane County Conservation District
Ness County Conservation District
Scott County Conservation District
Wet Walnut Creek Watershed Joint District No. 58

With Assistance by

U.S. Department of Agriculture
Soil Conservation Service
Forest Service

State of Kansas

Conservation Commission
Water Resources Board
Department of State and Extension Forestry
Forestry, Fish and Game Commission

April 1976

TABLE OF CONTENTS

TABLE OF CONTENTS

WATERSHED PLAN

Wet Walnut Creek Subwatershed No. 5,
Ness, Lane, and Scott Counties, Kansas

December 1975

SUMMARY OF PLAN

Subwatershed No. 5 covers 309 square miles in western Kansas in Ness, Lane, and Scott Counties. It is one of five watersheds which were planned jointly. It is sponsored by the Wet Walnut Creek Watershed Joint District No. 58, and Ness, Lane, and Scott County Conservation Districts.

The major problem in the watershed is flood damage along the South Fork of Wet Walnut Creek. Runoff from the watershed contributes to downstream flood damage. Average annual direct floodwater damages in the watershed are estimated to be $36,600 of which 88 percent is crop and pasture damage.

The proposed watershed project will consist of land treatment and structural measures. Adequate land treatment will be accomplished on 43,100 acres of cropland, 16,400 acres of rangeland, and 200 acres of forestland. Land treatment measures include 10 detention dams. Three floodwater retarding structures will be constructed.

Average annual flood damage will be reduced 63 percent. The average annual soil loss in the watershed will be reduced from 3.4 to 2.8 tons per acre. Average annual sediment yield from this watershed to Wet Walnut Creek will be reduced by 28,400 tons. Average annual recharge will be increased by 1,200 acre feet.

The major impact on the quality of water in South Fork Wet Walnut Creek will be the reduction of sediment load. Other impacts of the watershed project on the quality of streamflow will be minimal and localized. Increased base flows, decreased sediment concentration, and reduced erosion will increase fish habitat and food and water for all forms of wildlife in the watershed.

Aquatic habitat will, as a general rule, be improved with the impoundment and management of water in the sediment pools. Impoundments will increase both the fishery potential and the amount of suitable habitat for migratory waterfowl. Initially, there will be loss of terrestrial wildlife habitat. Land

treatment measures will increase wildlife cover and habitat diversity. The impounded areas will increase landscape diversity.

A five-year period will be required for project installation. Installation costs will be $2,802,800 of which $1,352,900 will be P.L. 566 funds.

Land treatment measures will be maintained by individual landowners and operators through agreement with conservation districts. Wet Walnut Creek Watershed Joint District No. 58 will be responsible for the operation and maintenance of floodwater retarding structures. Estimated average annual costs of operation and maintenance of structural measures are $2,900. Average annual benefits attributable to structural measures are expected to be $131,700; average annual costs for the measures are estimated at $89,600. Average annual flood damage reduction benefits from land treatment measures are estimated at $8,100.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Physical Data

Subwatershed No. 5 of Wet Walnut Creek Watershed Joint District No. 58 is in Ness, Lane, and Scott Counties in west-central Kansas. The watershed covers an area of 309 square miles; 43 square miles are noncontributing.[1/*] Dighton is the only city within the watershed. The watershed population in 1970 was 2,473 and 1,540 lived in Dighton.[2/]

The watershed is in the Arkansas-White-Red Water Resources region and the Arkansas River in Kansas Subregion.[3/] It is on the northern border of these regions. The watershed experiences periods of too little or too much water which typifies these regions.

The major problem in the watershed is flood damage along the South Fork of Wet Walnut Creek. No urban flood damages occur in the watershed. Sheet erosion is a problem on upland cultivated fields. Sedimentation in ponds, reservoirs, and stream channels is also a problem. Some areas along the streams present drainage problems. The pot-hole area in the western portion of the watershed experiences occasional temporary drainage problems. Recreational opportunities related to water are limited.

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* See list of references

Soils on uplands in the watershed are mostly of the Harney and Uly series in Ness County and the Richfield and Ulysses series in Lane and Scott Counties. Less extensive soils are classified as Canlon, Campus and Ness. Harney, Richfield, Ulysses and Uly soils are all deep, well-drained silty soils formed in calcareous loess. Harney and Richfield soils have nearly level and gentle slopes. Ulysses and Uly soils are gently to steeply sloping. The clayey Ness soils occupy upland depressions within areas of Richfield and Harney soils. The minor Canlon and Campus soils have steep and sometimes broken slopes that are adjacent to drainageways. Canlon soils are shallow and Campus soils moderately deep over Caliche. Rock outcrops are common within areas of these soils. Harney, Richfield, Ulysses and Uly soils are mostly cultivated and are productive of crops adapted to the area. Canlon, Campus and the steeper areas of Ulysses and Uly are not well-suited for use as cropland and most are used as native grass range.

Soils formed in alluvial sediments in the stream valleys are mostly of the Roxbury, Bridgeport, and Hord series. Roxbury and Bridgeport soils are on the lower flood plain and Hord soils are on the less frequently flooded terraces. The deep, well-drained to moderately well-drained Roxbury soils are calcareous silt loam or silty clay loam throughout. Bridgeport soils have much thinner dark colored surface layers than Roxbury soils. They are deep, well-drained calcareous soils with silt loam textures throughout. The deep, well-drained Hord soils are calcareous below depths of about 24 inches. They have silty clay loam textures throughout. These soils are well-suited for use as cropland and most are cultivated.

The detailed soil survey of Ness County is complete but not published. The field sheets, map legend, and interpretative information are on file in the Soil Conservation Service field office in Ness City. Soil surveys have been published for Lane and Scott Counties. Copies are available in the county SCS field offices.

Soil forming materials vary markedly within short distances. Mortar beds and Caliche (Ogallala Formation) form the cap-rock rim at the breaks from the High Plains. The bed-rock consists primarily of a yellowish, highly limy, chalk rock (Niobrara Chalk). In some areas the chalk rock has been eroded away and the gray limy shales, massive limestone, and dark, clayey shales (Carlile Shale and Greenhorn Limestone) are exposed.

The western three-fourths of the watershed lies within the natural land resource area known as the High Plains section of the Great Plains physiographic province and the eastern one-fourth lies within the natural land resource area known as the Blue Hills section of the Dissected High Plains physiographic province.4/

The Pleistocene Sanborn Formation and colluvial materials derived from it, and Pliocene and Cretaceous rocks, make up the surface materials covering most of the watershed. The Ogallala Formation underlying these materials over most of the watershed is exposed along valley walls and occurs as caps on the ridges. The Smoky Hill chalk member of the Niobrara Chalk underlies the Ogallala Formation. The rocks of the Smoky Hill chalk member are the oldest exposed in the watershed.

The watershed consists of nearly flat to gently rolling uplands dissected by relatively shallow valleys. The western portion of the watershed consists of flat pot-hole topography. The surface of the upland plain slopes eastward at approximately 10 feet per mile. The altitude of land surface ranges from 2,925 feet above mean sea level along the western watershed boundary to 2,180 feet at the watershed outlet. The maximum relief is 745 feet, but local relief seldom exceeds 100 feet.

The watershed drains into South Fork Wet Walnut Creek. South Fork Wet Walnut Creek heads in western Lane County. Although the watershed boundary extends into Scott County, this westernmost portion is generally noncontributing. The mainstem of Wet Walnut Creek is formed south of Ness City, Kansas, at the confluence of the South and North Forks of the creek. The eastern watershed boundary does not include this confluence. Wet Walnut Creek continues eastward through Subwatershed Nos. 1, 2, and 3 and empties into the Arkansas River four miles east of Great Bend. This watershed includes several unnamed ephemeral tributaries to South Fork Wet Walnut Creek. Ephemeral streams flow only during periods of general runoff. Wet Walnut and South Fork Wet Walnut Creeks have unmodified, well-defined natural channels. South Fork Wet Walnut Creek is a marginal intermittent stream. Occasionally it continues to flow after cessation of surface runoff. Spring discharges from the Ogallala Formation maintain perennial pools in parts of the major drains.

Normal annual precipitation at Healy is 18.65 inches and 19.82 inches at Scott City. The maximum yearly rainfall, 31.71 inches, occurred in 1948. The least rain, 8.92 inches, was received in 1956. More than 70 percent of the annual precipitation is received during the growing season which averages 167 days between April and September. High intensity thunderstorms usually occur during spring and summer months and often result in damaging floods. The normal annual temperature is 54 degrees. The range is from 116 to -31 degrees.5/

Most of the ground water is obtained from poorly consolidated sands and gravels of the Ogallala Formation. A major portion of this ground water recharge occurs in the 29,500 acre noncontributing drainage portion of the watershed. In places the sands of the Ogallala Formation are very poorly sorted and silt and fine sand fill the interstices, thereby decreasing the amount of space available for ground water. The lenticular sandstones in the subsurface Dakota Formation yield water to a few wells.

The alluvium in the South Fork Wet Walnut Creek valley is also a source of ground water. The volume of water estimated to be available for pumpage from the alluvium as of 1973 was 8,000 acre feet.

The most important mineral resource is water. There are no known mineral resources of greater economic importance. A small amount of sand and gravel may be obtained from the Ogallala Formation and Caliche beds in the Ogallala Formation are worked for road surfacing material. Oil and gas explorations have not been very profitable.

Land use in the watershed is as follows: cropland, 126,000 acres (63 percent); rangeland, 64,600 acres (33 percent); forestland, 1,000 acres (0.5 percent); and miscellaneous, 6,700 acres (3.5 percent).

In the flood plain 800 acres are irrigated. There are also 400 acres of rangeland, 300 acres of forestland, and 100 acres miscellaneous in the flood plain.

There are 1,000 acres of irrigated cropland in the upland. There are 121,300 acres of upland cropland. There are also 64,200 acres of rangeland, 700 acres of forestland, and 6,600 acres miscellaneous upland.

In its original or virgin condition, the major portion of the watershed was natural prairie consisting primarily of big bluestem, little bluestem, blue grama, western wheatgrass, buffalograss, and sideoats grama on the uplands. Big bluestem, little bluestem, and sideoats grama were dominant on the breaks between the uplands and lowlands. In prairie drainways and bottomland areas, the original vegetation was primarily big bluestem, indiangrass, switchgrass, and western wheatgrass.

Following settlement much of the native rangeland was plowed and converted to cropland. Many small pastures were fenced and grazed by livestock. Pastures were often heavily grazed year long, which altered the vegetative composition. On many pastures the taller grasses were largely replaced by less palatible plants or low growing grasses which could tolerate heavy grazing.

Principal grasses on the uplands are blue grama, sideoats grama, buffalograss, western wheatgrass, tall dropseed, annual brome, annual threeawn, windmillgrass, silver bluestem. Forbs and legumes include Louisiana sagewort, western ragweed, heath-aster, falsebonset, dotted gayfeather, Missouri goldenrod, whitebract hymenopappus, wavyleaf thistle, blue windindigo, Illinois bundleflower, and slimflower scurfpea. Woody plants consist primarily of skunk brush, plum, smooth sumac, and buckbrush.

Major grasses occurring on the lowlands are switchgrass, meadow dropseed, silver bluestem, big bluestem, indiangrass, western wheatgrass, blue grama, sideoats grama, buffalograss, Canada wildrye, and several species of sedge. Major forbs and legumes are Baldwin ironweed, tall goldenrod, western ragweed, giant ragweed, snow-on-the-mountain, maximilian sunflower, heathaster, poison hemlock, American licorice, and Illinois bundleflower. Woody plants include osageorange, American elm, black willow, cottonwood, hackberry, indigobush amorpha and buckbrush.

The Kansas Department of Health and Environment has developed surface water quality criteria.6/ The department states that the high incidence of low flows in Wet Walnut Creek inhibit detailed water quality analysis and the appli-cation of water quality criteria. No water quality records exist for Walnut Creek in this watershed.

There are no Types 3 through 20 wetlands in the watershed extensive enough to be included in the U.S. Fish and Wildlife Service inventory for Kansas.8/

Economic Data

All land within the watershed is privately owned except for a small amount used for roads, public buildings, and similar purposes. There is no significant publicly owned tract of land. The 291 farm operating units within the watershed average 603 acres in size.

Farming operations in the watershed are primarily centered around wheat, grain sorghums, and forage sorghums. Some of the sorghums are used for livestock production. Alfalfa is grown under irrigation or on the flat bottomland near South Fork Wet Walnut Creek without irrigation.

Principal Crops and Current Yields

		Flood Plain (flood free)		
	Unit	Dryland	Irrigated	Upland
Wheat	bu	25	45	19
Sorghum				
Grain	bu	40	43	39
Silage	tn	12	20	9
Soybeans	bu	18	35	-
Alfalfa	tn	3.0	5.0	3.0

The number of farms in the watershed is decreasing at a rate of one percent per year or less, as the trend toward larger farms continues. There are 36 family farms in the flood plain.

Selected data for 1969 includes:[26]

	Watershed	State of Kansas
Median Family Income	$7,081	$8,693
Families with incomes below poverty level	12%	9.7%
Unemployment level	1.3%	3.9%
Family Income Distribution		
Less than $3,000	12%	11%
$3,000 to $10,000	54%	49%
Over $10,000	34%	40%

Land values in the watershed range from $750 per acre for leveled and irrigated flood plain cropland to $300 per acre for unirrigated upland cropland and $200 per acre for rangeland.

A good transportation grid provides access to market for produce from the area. Kansas Highway 96 traverses the length of the watershed and State Highway 23 is a north-south route that crosses the watershed. The Atchison, Topeka and Santa Fe Railroad serves the watershed. It roughly parrallels the South Fork Wet Walnut Creek flood plain.

The watershed population in 1970 was 2,473 with 1,540 persons living in Dighton and 933 persons living on rural farms. The population by the year 2000 is projected to increase from 2,473 to 2,644 based on Barton, Lane, Ness, Rush, and Scott Counties historical trends.

Fish and Wildlife Resources

Fish habitat is scarce and limited to warmwater species within the watershed. Privately owned and stocked farm ponds provide fishing opportunities for largemouth bass, black crappie, white crappie, bluegill, carp, drum, channel catfish, and black bullhead catfish.9/ The quality of these resources ranges from poor to excellent.

Woody wildlife cover, provided by cottonwood, honey locust, red cedar, willow, elm, ash, Russian olive, mulberry, and osageorange, is limited to riparian sites and shelterbelts.10/ These wooded areas, along with the varied understory of shrubs, forbs, and grasses and adjacent croplands, provide critical habitat for upland game, deer, and other wildlife.

The effect of water quality on fish and wildlife resources, due to high sediment concentrations and inadequate quantities of water, has generally been damaging.

There are at present 38 miles of intermittent streams and 250 miles of ephemeral streams in the watershed.

Access is a primary factor limiting use of these resources. Most of the ponds and land bordering streams are owned by private individuals. Only persons with landowner permission have access.

Deer hunting, based on permit drawings, occurs in the watershed. Upland game in the watershed includes bobwhite quail, mourning dove, ring-necked pheasant, fox squirrel, cottontail rabbit, and black-tailed jackrabbit. Upland game hunting, particularly for ring-necked pheasants, is important throughout the project area. During wet fall seasons,

waterfowl use of marshy areas and potholes is extensive providing excellent hunting and bird watching.

There are no known endangered or threatened plant species in the watershed.11/

The Kansas Academy of Science lists the endangered whooping crane (Grus americana) as a possible transient in the watershed.12/ The American peregrine falcon (Falco peregrinus), another endangered species, may be a transient or winter resident.

The bald eagle (Haliaeetus leucocephalus), the prairie falcon (Falco mexicanus) and the burrowing owl (Speotyto cunicularia) are listed as threatened species that might be found within the watershed. Although no recent sightings have been made, the endangered black-footed ferret may also be a resident within the watershed.

The Kansas Academy of Science's endangered or threatened species list contains no known fish, amphibians, or reptiles that might be found within the boundaries of Wet Walnut Creek Watershed.

Recreational Resources

There are no federal or state recreational developments in this watershed and water related recreational opportunities are scarce. The closest major recreational area is Cedar Bluff Reservoir, about 25 miles north of the watershed. The Lane County State Fishing Lake (31 surface acres), 10 miles north of Dighton, and the lake in the Scott County Game Management Area, 25 miles northwest of the watershed also provide outdoor recreational opportunities. Water related recreation within the watershed is restricted to farm ponds. During drought periods most farm ponds and streams dry up providing very few waters that will sustain a permanent fish population.

Archeological and Historical Areas

The National Register of Historic Places does not list any historic sites in the watershed.13/

The archeology of this region has received little systematic investigation in the past. There are 12 reported archeological sites within the region. Data for the locations of previously known archeological sites along Wet Walnut Creek are primarily

from the activities of ameteurs and collectors reporting their work to the Kansas State Historical Society. The cultural time range known to be represented along Wet Walnut Creek is from the Paleo-Indian period to those of historic Indian tribes of the middle 19th century.

The Kansas State Historical Society reports no historic buildings or previously known archeological sites would be affected by the proposed structures.14/

An inventory of archeological resources for the proposed structure locations prepared December 1974 recommended:25/ (1) Testing to provide assessment and priority of archeological investigation for Structure No. 51. (2) All other proposed structures lack potential for prehistoric materials and no archeological evidence was found.

An assessment of archeological sites recommended by the inventory of December 1974 was made in July and August 1975 by a private archeologist in consultation with the State Archeologist.27/ Testing at all structures did not reveal sufficient cultural material to warrant further formal archeological investigation.

Soil, Water and Plant Management Status

There are no major changes in land use trends.

Conservation districts are active within the watershed. There is a total of 217 cooperators, and 191 basic plans have been developed covering 62 percent of the watershed. An estimated 45 to 70 percent of the needed conservation practices have been applied. Fifty-two percent of the cropland and 54 percent of the rangeland are adequately treated.

Conservation districts receive technical assistance from the Soil Conservation Service. Other agencies with programs affecting land use and treatment in the watershed are the Cooperative Extension Service, the Forest Service, and the Agricultural Stabilization and Conservation Service. The Extension Service, through county agricultural extension agents, assists with the informational and educational programs to carry out conservation objectives. The Agricultural Stabilization and Conservation Service shares the cost of installing certain permanent practices through its Agricultural Conservation Program or other programs. The Farmers Home Administration will make loans for

the installation of conservation practices when other funds are not available to the farm operator. Through cooperative agreements with the Forest Service and the Kansas State and Extension Forester, all of the grassland and woodland acres in the watershed are within rural fire district protection.15/ The Forest Service and the Kansas State and Extension Forester have also assisted in 400 acres of tree and shrub plantings.

There is presently a total of 800 irrigated acres in the flood plain. Irrigation pumpage for these acres exceeds the total average annual recharge. Additional recharge is needed to meet the desired demand for increased irrigation. The maximum aquifer storage in the main valley alluvium is 15,000 acre feet. As of January 1973 the aquifer contained 8,000 acre feet of recoverable water.

Water for upland irrigation and domestic and stock uses is obtained from wells in the Ogallala Formation. The lenticular sandstones in the Dakota Formation yield water to a few wells. Some stock wells tap saturated stream alluvium.

The communities of Alamota, Beeler, and Laird obtain ground water from sources other than the limited alluvial aquifer. Dighton's five wells ranging from 96 to 147 feet in depth obtain water from the Ogallala Formation. It appears there will be no appreciable increased demand for additional water supplies in the watershed for municipal or industrial use in the near future.

WATER AND RELATED LAND RESOURCE PROBLEMS

Land and Water Management

Rangeland was first exposed to the plow in the middle 1800's. A gradual increase in cropland has occurred since the first plowing, reaching a maximum around 1937. In 1974, 1,244 acres of rangeland were converted to cropland. An active land treatment program began in 1941. However, in 1974 conservation cropping systems were needed on 21,351 acres of cropland; rangeland and woodland conservation practices were needed on 30,238 acres.

Erosion is a problem on cultivated uplands where needed land treatment has not been installed. The average cropland soil loss is 4.7 tons per acre per year. Soil loss results in depletion of soil resources, reduction of crop yields and

income, sedimentation in farm ponds and on the flood plain, as well as deterioration of stream quality and increases in road maintenance costs.

Soil fertility is not generally a problem, however, low fertility becomes a problem on eroded lands. Available soil moisture is a limiting factor in crop production in most years. Moisture conserving practices such as stubble mulching, terracing, and contour farming are needed on cropland. Excessive tillage operations on many farms reduces ground cover, increases compaction, crusting, and runoff; and uses more fuel than necessary. Land use adjustments needed are mostly cropland to grassed waterways.

Most landowners are economically able to install needed land treatment with the help of federal cost-sharing programs.

Floodwater Damage

Damage resulting from flooding (1.8 year frequency or greater event) is the principal watershed problem. Rain received in this area can cause more severe flooding downstream than in this watershed.

The evaluated flood plain covers 4,400 acres and includes 3,600 acres of cropland. Crop and pasture damage due to flooding averages $32,100 annually and accounts for 88 percent of the total direct floodwater damage.

Damages caused by floodwater occur throughout the flood plain of the watershed. A total of 36 farm units are subject to damage. Flood damages occur on 15,300 acres off project immediately downstream from the Subwatershed No. 1 on Wet Walnut Creek flood plain. Part of this area is comprised of: urban and suburban 320 acres, cropland 9,910 acres, and pasture and miscellaneous lands 2,870 acres. The remainder occurs on flood plain common with the Arkansas River and is comprised of: urban and suburban 680 acres, cropland 1,290 acres, and pasture and other land 230 acres. Flood damages also occur on 34,061 acres of flood plain in Subwatershed Nos. 1, 2, and 3.

Flooding damages buildings, fences, machinery, cattle and hog pens, feed bunks, and stock tanks. Considerable expense is incurred for clean-up of debris after flooding. Agricultural damages of this type average $4,100 annually.

Floodwater damage to roads and bridges average $400 annually. Floods wash away road surfacing, scour road shoulders, fill in road ditches with mud on 1.2 miles of road, and damage 4 bridges. County and township budgets are not usually sufficient to make timely replacements and repairs following a flood. This work is necessarily spread over a number of years, hence these essential facilities remain in a subnormal condition.

Small, localized floods frequently cause considerable damage and inconvenience to farmers in the watershed. A major flood affects everyone in the area due to damaged roads, bridges, utilities, and loss of business to those serving the agricultural community. Such indirect losses are estimated at $3,700 annually.

In summary, the total average annual direct floodwater damages are estimated at $36,600 as shown in Table 5. There are also unevaluated damages to wildlife in the flood plain. Ground nesting birds are especially hard hit by floods occurring between April and August; the period of occurrence of 75 percent of the floods. Flooding destroys protective habitat, nests, and young birds. Terrestrial species in the flood plain may be displaced or killed by floods. Displacement may result in increased predation, starvation, or disease.

Sediment and Erosion Damage

Soil erosion is a problem, the highest soil losses occur on cropland. The average annual soil loss from cultivated upland fields ranges from 1 to 11 tons per acre with an overall average of 4.7 tons per acre. Some steeply rolling rangeland is gullied. Average annual soil loss from rangeland is 1.3 tons per acre.

The annual sediment yield per square mile ranges from 300 to 700 tons in the watershed. An estimated 170,000 tons of sediment is delivered to the Arkansas River annually from the Wet Walnut Creek Basin. This watershed contributes an estimated 28,000 tons of sediment annually to the Arkansas River. Sediment yield from this watershed is 39,000 tons per year. Channel fill deposits, primarily silt and clay sized particles, continue to decrease channel capacities. These deposits result in average annual flooding damages of $2,100.

Recreation

The Kansas State Outdoor Recreation Plan indicates that the single most important outdoor recreation need in this area is water.[16] Fishing needs identified for the 1970 population of 128,200 within a 50-mile radius would be satisfied by recreational developments in Subwatershed Nos. 1, 2, and 3.

Fishing in the Wet Walnut Creek is poor because of sediment pollution and low water quantity. Fishing in farm ponds ranges from poor to excellent depending on water quality, permanence, and management. Most fishing is restricted to family and close friends of landowners. The need exists for a stable fishery available to the public. There are no public lands within the watershed which may be used for fishing or hunting.

Fish and Wildlife

There is a need for more wildlife habitat, particularly cover, throughout the watershed. A substantial increase in cover would tend to be in competition with agricultural production, although some compatible increases are possible.

Economic and Social

The watershed is not an economically depressed area. It is composed of family farms. None of the farms in the district use one and one-half man years or more of hired labor at present. There is a need to provide additional employment opportunities in order to give young people options other than migration to an urban area. There is a general need to establish rural community development in the watershed.

Other

A need exists for outdoor educational facilities.

PROJECTS OF OTHER AGENCIES

While there are no major projects proposed by other agencies within the watershed, the Corps of Engineers has an authorized local flood protection project at Great Bend. This project and the watershed projects are complementary. The watershed projects would supplement the protection offered in Great Bend. One effect of the watershed projects will be to reduce the Corps of Engineers standard project storm peak discharge by 35 percent. The local flood protection project would protect Great Bend from floods on both the Arkansas River and Wet Walnut Creek. The current estimated cost is 18.4 million dollars, of which 3.7 million dollars would be non-federal. Construction of the local flood protection project is pending passage of a bond issue by local voters.

PROJECT FORMULATION

Subwatershed No. 5 is one of five watersheds in the Wet Walnut Creek Watershed Joint District No. 58 which covers the entire Wet Walnut Creek basin for the lower few miles. The five watersheds were planned concurrently. One of the watersheds proved economically unfeasible for a P.L. 566 program. The watershed district has complied with applicable Kansas Laws in organizing and carrying out their activities.

Shortly after the flood of September 1959, the first steering committee was selected. Interested citizens held their first public meeting May 8, 1961. The 18 banks of the area provided funds for organizing the watershed. Petitions calling for a formal vote were submitted to the Secretary of State May 16, 1963. The first board of directors was selected July 11, 1963. A favorable vote was taken October 29, 1963. A Certificate of Incorporation was issued by the Secretary of State November 22, 1963.

An application for federal assistance under Public Law 566 was submitted to the State Soil Conservation Committee September 30, 1964. Approval by the State Soil Conservation Committee was granted December 18, 1964. A joint study of Wet Walnut Creek as part of the Upper Arkansas Basin by the Soil Conservation Service, Forest Service, Economic Research Service, and the Kansas Water Resources Board was started May 4, 1965. The State Soil Conservation Committee assigned a priority for planning July 31, 1967. A ground water recharge study was started in the Wet Walnut Creek Basin as a cooperative venture of the Kansas Water Resources Board, the U.S. Geological Survey, and the Wet Walnut Creek Watershed District during the summer of 1968.

Preliminary planning led to project formulation meetings where 54 sites were selected for P.L. 566 status and 45 additional sites were selected to be built with other federal assistance programs over the five watersheds. Most of these sites remain in the plans. Planning was authorized by the Soil Conservation Service Administrator January 13, 1969.

The watershed board of directors maintains an active and continuing interest in promoting conservation of all kinds within the district. They employ a full-time watershed manager

and have held monthly public meetings throughout the history of the district. In the course of these activities, many alternatives have been considered. The public has had ample opportunity and repeated encouragement to provide inputs into the development of the objectives and project formulation. The local press has given extensive coverage to the activities of the district and the general level of public awareness of the plans is very high.

The General Plan for the Wet Walnut Creek Watershed Joint District No. 58 was approved by the watershed board of directors and the Kansas Division of Water Resources of the State Board of Agriculture March 30, 1972.23/ Modifications were made and approved in February 1973 and January 1974. Well-publicized public hearings were held at each of these steps.

Objectives

Original goals of sponsors were expressed in the applications, dated September 30, 1964. The goals were stated in general terms by types of benefits expected through project action. As planning progressed the goals became more specific and better defined. The redefined goals, including those of the Soil Conservation Service are summarized herein according to project purpose.

Watershed Protection (Conservation Land Treatment): Reduce soil loss on 43,100 acres of cropland and 16,400 acres of rangeland to allowable levels. The allowable soil loss for a typical upland soil is 5 tons/acre/year.1/

Manage land within its capability. Manage croplands through implementation of conservation practices: conservation cropping systems, stubble mulching, minimum tillage, contour farming, and the installation of terraces, diversions, grassed waterways, and drainage systems. Convert cropland to rangeland where appropriate and improve management practices on existing rangeland. Manage rangelands through proper grazing use, planned grazing systems, brush management, and the strategic placement of stock ponds.

Reduce sediment load to a point that no new deposition occurs in the main Wet Walnut Creek channel. The objective is to maintain or improve present capacity and ground water recharge capability of the channel.

Flood Prevention: Reduce average annual flood damages to crops, agricultural properties, roads, bridges and public utilities by 60 percent on 38,500 acres of flood plain within the watershed district. Reduce flooding in urban areas to confine damage to streets, lawns, and parks.

Recreation: The lack of physically feasible reservoir sites for the purpose of recreation lead to the sponsors' decision to forego alternatives for providing recreation development.

Fish and Wildlife: Enhance fish and wildlife resources within the watershed through land treatment measures, land use conversions, and establishment of impounded water. Where habitat losses unavoidably occur due to installation of structural measures, they are to be mitigated.

Alternatives

Five alternatives considered in formulation of the project plan are displayed in the table on the next page. These alternatives were analyzed for physical feasibility, sources of authority, availability of local sponsors, effect on adverse environmental impacts, viability, and cost. A viable alternative is defined as one which is physically feasible and could be carried out under an existing authority. Cost estimates are included only for viable alternatives that reduce or eliminate adverse impacts of the proposed project.

Alternative No. 5-1 is the same as the proposed project except that sediment pools of floodwater retarding structures would be dry. These dry impoundments would result in conversion of five miles of intermittent and one mile of ephemeral streams and associated flood plains to 229 acres of frequently flooded odd area habitat. The project would result in 600 acre feet of additional ground water annually. Evapotranspiration would be increased by 1,000 acre feet annually. The average annual discharge would be reduced 1,500 acre feet. The aesthetic and incidental benefits associated with the development of 229 acres of aquatic habitat would be foregone. The cost of this alternative would by $2,732,200.

Alternative No. 5-2 is to allow present trends to continue. The existing land treatment program would continue. Net project benefits of $42,100 would be foregone.

WET WALNUT CREEK SUBWATERSHED NO. 5

MATRIX ANALYSIS OF ALTERNATIVES (X = yes, 0 = no)

Alternative No.	Description	Alternative Components			Physical Feasibility	Authority		Local Sponsorship	Effect on Adverse Impacts	Viable	Installation Cost ($)
		ACC LT	Z & I	FRS No.		PL 566	Other				
5-1	As planned, but with dry pools	X		3	X	X		X	Reduce	X	2,732,200
5-2	No Project				X		X	X	Eliminate	X	945,900
5-3	Acc. L. T.	X			X	X	X	X	Eliminate	X	1,391,100
5-4	Acc. L. T. and nonstructural measures	X	X		X	0	0	0	Eliminate	0	
5-5	Acc. L. T. and Site 51	x		1	X	X	0	X	Reduce	X	2,065,300

ACC LT - Accelerated Land Treatment (all alternatives include on-going land treatment)
FRS - Floodwater Retarding Structure
Z & I - Flood Plain Zoning and Flood Plain Insurance

Alternative No. 5-3 consists of accelerated land treatment only. Resource management systems would be installed in five years on 59,700 acres of agricultural land. The average annual soil loss from upland soils would be reduced from 3.4 to 2.8 tons per acre. The average annual sediment deposition in existing ponds would be reduced 17 percent and the average annual sediment yield to the watershed outlet would be reduced from 39,000 to 25,600 tons. The cost of this alternative would be $1,391,100.

Alternative No. 5-4 is the same as Alternative No. 5-3 with the addition of flood plain management including zoning to those uses best adapted to flooding. Agricultural use of flood plain land will be controlled. State law prohibits restriction of agricultural use of land. Flood insurance would be made available to all communities. This alternative would require additional studies for evaluation.

Alternative No. 5-5 consists of accelerated land treatment and one floodwater retarding structure. The floodwater retarding structure would replace 2.5 miles of intermittent stream and associated flood plain with 122 acres of aquatic habitat. Identified flood damages would be reduced 30 percent on 4,446 acres of flood plain below the proposed structure. Accelerated land treatment would improve the soil, water, and plant management on 59,700 acres. The average annual soil loss from upland soils would be reduced from 3.4 to 2.8 tons per acre. The average annual sediment deposition in existing ponds would be reduced from 39,000 tons to 16,000 tons. The project would result in 800 acre feet of additional ground water annually. The cost of this alternative would be $2,065,300.

All viable alternatives were evaluated in terms of their effects on watershed problems and planning objectives. Alternatives which provided the maximum reduction in average annual flood damages for the watershed were considered most desirable for the following reasons:

The flood plain is already extensively used, mostly for agricultural enterprise. Any reduction in present or future agricultural use of the flood plain would be undesirable as an alternative because of the importance of agricultural production to the area's economy.

After consideration of all viable alternatives that could reduce or eliminate adverse project effects, the proposed

project, which includes conservation land treatment and all economically justifiable floodwater retarding structures, was selected.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

Resource management is essential to a sound watershed protection and flood prevention program. Farmers and ranchers, in cooperation with the conservation districts, will develop conservation plans to achieve proper land use and conservation.

Adequate land treatment will be implemented on 43,100 acres of cropland, 16,400 acres of rangeland, and 200 acres of forestland. Conservation agreements must be obtained from operators of at least 50 percent of the land in drainage areas above reservoirs before construction of the structure is started. Additionally 75 percent of the effective land treatment measures must be applied to sediment source areas which, if uncontrolled, would require a material increase in the cost of construction, operation, or maintenance of the structural measure. Provisions for installation of these measures before or concurrent with construction must be made in each project agreement. The resource management systems will include all practices that are needed for desired and compatible use of a particular land area. Land use conversions needed to establish proper conservation of the watershed resources include 8,984 acres of cropland to: hayland, 259 acres; rangeland, 8,152 acres; wildlife and recreation land, 116 acres; forestland, 26 acres; and other uses, 431 acres; and 1,062 acres of rangeland to wildlife and recreation land.

Alternative conservation practices for cropland resource management systems include:

Conservation Cropping System: Using needed cultural and management measures for crops. Cropping systems include rotations that contain grasses and legumes as well as rotations in which the desired benefits are achieved without these crops.

Stubble Mulching: Managing plant residue on a year-round basis in which harvesting, tilling, planting, and cultivating are performed to keep protective amounts of vegetation on the soil surface.

Minimum Tillage: Limitation of cultivation to that essential to crop production and prevention of soil loss.

Gradient Terraces: A system of earth embankments, ridges, and channels constructed along a slope at a suitable spacing and with an acceptable grade.

Level Terrace: An earth embankment or a ridge and channel constructed across the slope at a suitable spacing with no grade.

Diversion: A channel with a supporting ridge on the lower side constructed across a slope. Diversions are constructed to divert water from areas where it is in excess to sites where it can be used or disposed of safely.

Contour Farming: Cultivation of sloping land at right angles to the slope. This includes following established grades of terraces, diversions, or contour strips.

Grassed Waterway or Outlet: A natural or constructed passageway for water with vegetation established that is suitable for safe disposal of runoff from a field, diversion, terrace, or other structure.

Drainage: Disposal of excess water in a field by grading to reshape the land surface or by construction of a graded ditch.

Artificial Ground Water Recharge System: A conservation practice system for temporary surface storage of excess runoff to be infiltrated into the soil and percolated to the ground water table.

Rangeland is used for grazing livestock and big game animals. The natural plant community is dominated by grasses, grass-like plants, forbs, legumes, and shrubs. The primary practices among alternatives for rangeland are:

Proper Grazing Use: Grazing at an intensity which will maintain enough cover to protect the soil and maintain or improve the quality and quantity of desirable vegetation. This can be accomplished by stocking at rates compatible with forage production where summer-long grazing is practical or by rotating grazing use between two or more pastures. Cropland forage to produce seasonal pasture, hay, or silage can be planned to supplement rangeland pastures.

Planned Grazing Systems: A system in which two or more grazing units are alternately rested from gazing in a planned sequence over a period of years. The rest period may be throughout the year or during part of the growing season. Many pastures in the watershed contain sufficient amounts of desirable plants to recover rapidly through periodic deferments.

Brush Management: Manipulation of stands of brush by mechanical, chemical, or biological means. This includes reducing excess brush and weeds to restore natural plant community balance and manipulation of brush stands through selective and patterned control methods to meet specific needs of the land and objectives of the land user.

Range Seeding: Establishing adapted plants by seeding on rangeland.

Pond: A water source for livestock made by constructing a dam or embankment or by excavating a pit.

Detention Dam: A dam or embankment to temporarily detain floodwater to regulate the rate of flow in a watercourse.

Woodland is used primarily to produce adapted woody plants, to provide cover to protect fields and farmsteads from inclement weather, and to supply watershed protection, wildlife habitat, and landscape diversity. For optimum maintenance or improvement of hydrologic conditions, woodland must support vigorous, fully stocked stands of trees with undisturbed ground cover. Benefits from woodland management will be sustained by realizing the maximum economic returns consistent with site capability. To obtain these objectives, the following land treatment measures will be employed:

Woodland Improvement: This may include harvesting mature trees, removing poor quality or less desirable trees, and pruning the managed species.

Windbreak and Shelterbelt Planting and Renovation: Planting tree and shrub seedlings to establish new or renovate existing shelterbelts and windbreaks. Renovation may also include the removal or pruning of existing plants or the adoption of improved management practices.

Hedgerow Replacement or Renovation: Hedge seedlings may be planted to establish permanent field borders and add to wildlife habitat and landscape beautification.

Grazing Control: Grazing can damage young trees and cause soil erosion and compaction. All new plantings and cultural operations should be protected from grazing livestock. Some good quality young native timber also needs protective fencing.

Tree and Shrub Plantings: Special shelterbelt plantings are planned for each flood control structure to break up summer winds and thereby reduce evaporation. These plantings are planned to maximize their value for wildlife habitat and site beautification. Plantings in other areas will serve similar purposes.

An educational program is planned to inform rural residents of the economic and wildlife benefits that can be gained from excluding livestock from woodlands and shelterbelts.

A forestry work plan was developed for the watershed by the Kansas State and Extension Forester, in cooperation with the U.S. Department of Agriculture, Forest Service.15/ Forestry technical assistance provided through the existing Cooperative Forest Management Program and P.L. 566 Program will adequately serve the needs of the watershed forestlands throughout the life of the project.

Although the watershed area is protected by rural fire districts, new districts need to be organized in response to additional, documented fire protection needs. Fire prevention education programs will be developed. Technical assistance for fire control measures will be provided by the Kansas State and Extension Forester.

Cost of improved fire control equipment and facilities is to be borne by rural fire districts. Technical fire control assistance will be provided from going programs.

As part of the land treatment measures to be installed, the watershed district in cooperation with the conservation districts will work with landowners to install approximately 10 detention

dams. These dams will control drainage areas ranging in size from 1.9 to 20.8 square miles for a total of 57.5 square miles or 18.5 percent of the drainage area in the watershed. These dams will provide detention of runoff water averaging two inches per square mile. The total estimated flood storage for the 10 detention dams is 6,130 acre feet. Sediment pools will store 1,230 acre feet.

Watershed directors and conservation district supervisors are furnishing part-time technical assistance to accelerate installation of soil and water conservation treatment. Provisions have been made for personal contact with landowners and operators to urge them to establish conservation practices on their farms. During this contact people will be informed about the watershed program and its progress. Underlying these efforts is the importance of landowner-operator understanding that these treatment measures not only benefit them individually but also are necessary prior to building floodwater retarding structures in the watershed.

Structural Measures

A system of three floodwater retarding structures will be installed at locations shown on the project map.

All structures will be earth dams with vegetated emergency spillways provided to release runoff exceeding reservoir storage capacity safely past the dam. All foundations are classified as yielding and consist mostly of silty clay. Emergency spillways have been planned so that their chance of operation in any one year is two percent or less. A cross section of the typical structure is shown in Figure 1. (Page 57)

At all sites the predominant emergency spillway material to be excavated is silty clay. The remaining material to be excavated will be shale and limestone.

The predominant borrow material at all sites will be silty clay. The intended borrow area is the sediment pool and emergency spillway excavation. Clearing will be necessary in the borrow areas; however, any opportunity to retain trees and brush will be given special consideration.

All structures will have a drop inlet type principal spillway with single stage inlets near the elevation of the estimated 100-year accumulation of sediment. Principal

spillways will be reinforced concrete, or a material of comparable quality and strength. Average uncontrolled release rates of 3.5 cubic feet per second per square mile of drainage area above the structure will not exceed downstream channel capacities.

Natural streamflow is to be passed through the dams to meet downstream water rights as provided by the Kansas Water Appropriation Act. Principal spillways will include 8-inch minimum diameter drawdown pipes with control valves to permit low flow releases regardless of reservoir storage elevation.

The floodwater retarding structures will have a total of 9,558 acre feet of floodwater storage. Retarding storage will vary from 1.70 to 2.90 inches of runoff from the drainage area. Drainage area controlled by the structures will range from 8.4 to 58.8 square miles. A total of 31.4 percent of the drainage area in the watershed will be controlled. Sediment storage will be provided for the expected 100-year accumulation of 1,471 acre feet. Sediment storage volumes range from 0.19 to 0.49 inches from the drainage areas.

Sediment pools in all the floodwater retarding structures will have some potential for limited recreational use. Access to these structure sites will be controlled by landowners. Access by the general public will be prohibited unless or until adequate sanitary facilities are provided to meet state and local health requirements. The watershed district will notify the State Department of Health and Environment if adequate sanitary facilities are not provided.

Under present conditions, the project will not result in relocation of any person, business, or farm operation.

A road involved with Site No. 51 will be raised to allow installation. See Table 2 for estimated cost.

Record search and field examinations confirm abandoned oil or gas wells in the reservoirs areas to be adequately plugged. No producing gas or oil wells will be affected by structural measures.

Specific measures to offset wildlife losses and enhance habitat have been recommended for each structure site. Maps and descriptions of these measures are included in a report by the U.S. Fish and Wildlife Service.10/

Compensating measures have been adopted as design features for each structure. The dams and spillways of the three floodwater retarding structures will be fenced and seeded to a grass-legume mixture suitable for wildlife. A specific odd area adjacent to Structure No. 52 as designated in the Fish and Wildlife Service Report will be within the permanently fenced and seeded area. Mature trees will be preserved where possible.

Enhancement measures recommended in the Fish and Wildlife Service report for installation by the sponsors at the floodwater retarding structures include: additional odd-areas and tree and shrub plantings within the permanently fenced area; seeding cropland within a one foot vertical elevation of the sediment pool to switchgrass; leaving as much woody vegetation within the sediment pools as possible; constructing brush piles suitable for wildlife using trees cleared for construction; and planting borrow areas within the sediment pool to a quick cover crop. None of the enhancement measures have been adopted as a part of this plan.

The need for water and air pollution abatement during construction will be determined on a site-by-site basis. Abatement measures may include dry stream crossings, temporary vegetative establishment, watering for dust control, controlled burning, and sediment control basins.

The Soil Conservation Service will in consultation with the State Historic Preservation Officer maintain close communication with the State Archeologist during project construction so that any finds may be investigated to determine the need for emergency salvage. The National Park Service will also be notified of any discoveries. If necessary, the Secretary of the Interior will be asked to determine the site's eligibility for inclusion on the National Register. The Advisory Council on Historic Preservation will be requested to comment on any site affected by project activities which have the qualities to make it eligible for inclusion in the National Register of Historic Places. This is in accordance with section 106 of the National Historic Preservation Act, PL-89-665, 16 USC 470(f). Since this is a federally assisted local project, there will be no change in the existing responsibilities of any federal agency under Executive Order 11593 with respect to archeological and historical resources.

EXPLANATION OF INSTALLATION COSTS

Needed land treatment measures and their estimated costs are shown in Table 1. The estimated total planning and installation cost for land treatment is $1,391,100. Public Law 566 funds will provide $83,000 of this total for technical

assistance to accelerate the current program. Other sources will provide the remaining $1,308,100 for installing these measures. Land treatment installation costs include 10 detention dams. All land treatment cost estimates are based on present costs under current programs.

Structural measures and their estimated costs are also shown in Table 1. These costs are separated by individual structure sites in Table 2. The total estimated cost for all structural measures is $1,411,700. The following discussion of structural measures costs deals first with the major elements listed in Table 1 (construction, engineering services, relocation payments, project administration, and land rights). Next is an explanation of the estimated structural cost distributions found in Table 2.

Construction cost estimates are based on topographic survey data and unit costs of similar work on other projects. A contingency allowance of 12 percent was used; however, no unusual construction problems are anticipated.

Engineering services include all direct and related costs of surveys, geologic site investigations, soil mechanics, structure design, construction plans and specifications.

Relocation payments are made to those landowners and farm operators who are displaced from their farm operations. These costs include moving and expenses of searching for a replacement farm location or payments for direct losses of personal property if the farm operation is not relocated. There are no relocation payments anticipated.

Project administration costs are P.L. 566 and other administrative costs associated with installation of structural measures. These costs include contract administration, review of engineering plans prepared by others, and necessary inspection service during construction to see that structural measures are installed in accordance with plans and specifications. Project administration cost to the district also includes relocation assistance advisory services. These services shall provide (1) measures or facilities necessary to determine relocation assistance needs, (2) information regarding replacement property, (3) informational brochures, (4) assurance of replacement dwellings, and (5) assistance in getting established. In addition to relocation assistance advisory services, the sponsors and the Service will be involved in administrative functions in connection with relocation payments. The sponsors and the Service will each bear the costs they incur. These shall include costs for: (1) serving notice of displacement, (2) providing application forms, (3) assisting in filing applications, (4) hearing and resolving grievances, and (5) making

relocation payments. The Service will assist the sponsors in carrying out these administrative functions.

All land values were determined by the Wet Walnut Creek Watershed Joint District Board of Directors and agreed to by the Soil Conservation Service where the watershed district is to pay the entire cost. Land cost estimates are based on current land values which vary from $200 per acre for grassland to $750 per acre for leveled and irrigated cropland. Land cost estimates also include appraisal fees. Estimated may not coincide with actual out-of-pocket costs to the local organizations because some easements may be donated.

Costs paid by P.L. 566 for the three floodwater retarding structures include all the construction and engineering services costs. Part of the project administration costs will also be paid from P.L. 566 funds. The district will pay for land rights including road modification costs associated with Structure No. 51.

The total project administration cost is estimated to be $342,900. Public Law 566 will bear $319,500 of this cost and other funds will pay the remaining $23,400. The Service and the sponsors will each bear the costs they incur.

Estimated total P.L. 566 costs and other obligations by fiscal years during the project installation period are as follows:

Land Treatment

Fiscal Year	P.L. 566 Costs	Other Costs	Total
First	12,400	196,200	208,600
Second	20,800	327,000	347,800
Third	20,800	327,000	347,800
Fourth	16,600	261,600	278,200
Fifth	12,400	196,300	208,700
Total	83,000	1,308,100	1,391,100

Structural Measures

First	63,900	44,800	108,700
Second	396,000	62,000	458,000
Third	286,000	25,600	311,600
Fourth	286,000	4,700	290,700
Fifth	238,000	4,700	242,700
Total	1,269,900	141,800	1,411,700

EFFECTS OF WORKS OF IMPROVEMENT

Flood Prevention, Erosion, and Sediment

The planned project will reduce the 100-year flood near the watershed outlet from 34 c.s.m. to 24 c.s.m. and would eliminate flood damage up to the 2.2 year flood. The project will reduce damages from a 10-year frequency flood from $7,150 to $3,770, a reduction of 47 percent.

The effect on the area flooded by the 100-year frequency storm is shown in the following table:

Reach[a/]	Area Inundated 100-Year Frequency Storm	
	Without Project (Ac)	With Project (Ac)
X	410	206
XI	2,551	1,581
XII	1,485	935
Total	4,446	2,722

a/ Reaches XIII (450 acres) and XIV (60 acres) were not evaluated.

Average annual flood damages will be reduced by 63 percent in this watershed. A 19 percent reduction will result from land treatment applied to this watershed, and 44 percent from structural measures in this watershed. The watershed program will benefit all or parts of 19 farms on the evaluated flood plain. In addition, the project will benefit directly or indirectly all of the 2,473 inhabitants of the watershed (including 17 farms with 510 acres of non-evaluated flood plain having significant damage only with floods approaching or exceeding the 100-year frequency storm) and 183 farms (49,361 acres) and 22,235 urban, suburban or small town inhabitants downstream on the Wet Walnut Creek flood plain.

The project will increase the level of flood protection of the planned local protection works at Great Bend. The requirements of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 will serve to regulate further development of designated flood prone areas. No communities in this watershed have been designated flood prone. If Lane County becomes eligible under the program all rural residents may purchase flood insurance.

Land use and cropping patterns on the flood plain are not expected to change greatly. Decreased flooding will allow more intensive use of 1,506 acres. The land treatment program

should result in more efficient use of land and water resources and, thus, increase farm income.

Average annual soil loss in this watershed will be reduced from 3.4 to 2.8 tons/acre. Changes in soil losses by land use will be: cropland 4.7 to 3.9 tons/acre; rangeland 1.3 to 1.1 tons/acre; forestland and miscellaneous no change. The project will reduce scour.

The combined effects of the four watershed projects will reduce the total average annual sediment yield to the Arkansas River from an estimated 170,000 tons to 86,400 tons.

Normal release of retarded floodwater will result in increased ground water recharge.[17] Principal spillways are planned to operate at about bank full capacity throughout the tributary and mainstem channel reaches. More than one-half of flows that would normally pass a given point over a 2- to 3-day period will be detained within the channel banks for 20 to 30 days. Storage in reservoirs and increased channel flow duration will increase recharge in this watershed by 1,200 acre feet annually. Reduced flood plain inundation does not reduce the net recharge increase since a negligible amount of natural recharge takes place through flood plain soils and subsoils.

The average annual sediment yield from this watershed to Wet Walnut Creek will be reduced by 28,400 tons. However, the average annual sediment yield from this watershed to the Arkansas River will be reduced by 22,400 tons.

The water quality standards for Kansas streams such as South Fork Wet Walnut Creek are already being met. They will still be met following completion of the watershed project.[18] The major impact upon quality of water in South Fork Wet Walnut Creek and its tributaries will be the reduction in sediment load.

Other effects of the watershed project on the quality of streamflow will be minimal and localized, however, the lack of data concerning the effects of completed watershed projects on streamflow quality prevents any detailed predictions. It is likely that some reduction will occur in organic waste and nutrient levels.

Fish and Wildlife

Base flow in main streams will be increased, as will the flow in all streams below structures. Prolonged releases and seepage from the reservoirs are expected to provide additions to low flows in Wet Walnut Creek. During some periods reservoir levels will be below principal spillway inlets. Natural stream flow will be passed through the dams during drought periods as required to meet downstream water rights.

Some soil erosion and air and water pollution will occur during reservoir construction. These effects will be minimized.

A reduction in mortality to species inhabitating the flood plain below structures will occur due to reduced flooding. Rather than increasing population levels, this will probably tend to stabilize populations in that area.

Nine acres of cropland and 454 acres of rangeland in sediment pools will be lost to agricultural and terrestrial wildlife habitat use. Periodic flooding of 1,563 acres of retarding and detention areas will interrupt and reduce agricultural and wildlife uses. In addition, construction of dams and spillways on 20 acres of cropland and 257 acres of rangeland will largely displace these uses; however, revegetation will return most of the land to wildlife habitat.

Measures to enhance fish and wildlife habitat (fencing and seeding areas to grasses and legumes, additional tree and shrub plantings, and seeding pool areas to quick cover crops) will increase fish and wildlife habitat. Installation of land treatment measures will improve terrestrial wildlife habitat by increasing habitat diversity.

Project measures will create 463 surface acres of habitat for aquatic species and migratory waterfowl. They will improve the Wet Walnut Creek stream fishery.

Impoundments will inundate three miles of ephemeral stream, and three miles of intermittent stream.

The proposed project should have no impact on endangered or threatened species, other than to increase the possible number of resting places available to the whooping crane, a possible transient resident in the area.12/

Archeological, Historic, and Scientific

Project measures will have no effect on any known historical or archeological sites. The State Historic Preservation Officer and the National Park Service will be notified immediately of any archeological sites discovered during construction.

Economic and Social

The works of improvement will have a positive effect on the area economy. Construction of the P.L. 566 structures will provide 29 man years of new employment over a 5-year period. Operation and maintenance will provide .3 man year of employment annually. These employment opportunities will primarily benefit low and moderate income groups of the area.

There will be a positive effect on the quality of living for many watershed residents resulting from increased capital made available by reduced floodwater damages and more intensive use of property used in agricultural production. In addition, the general public, especially watershed residents, will benefit from better roads as a result of the reduced maintenance and repairs of the road system.

The project offers a sound basis for rural development. Farm operations in areas where a high degree of flood protection is offered have a better chance of survival. Thus a reversal in the trend of declining numbers of farms could be more likely with the project.

Secondary benefits will result from transporting, processing, and marketing greater amounts of agricultural commodities produced as a result of reduced crop losses. Increased farm incomes will mean increased consumer expenditures for farm equipment and material to local retailers and wholesalers. Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation. An increase in job opportunities and the economic benefits associated with additional commercial growth activities, particularly those which service the recreational areas, will accrue to the watershed and region.

In addition to the monetary benefits, there are other substantial intangible benefits which will result from the

project. These include better living conditions, a sense of economic security, and the psychological security associated with the abatement of a fear of flooding.

Sediment pools of the floodwater retarding structures and detention dams will be of some benefit to agricultural operations by providing livestock water supply.

Other

The following land use changes are expected to occur during the installation period of the project:

Land Use	Present (acres)	End of Installation (acres)	Net Change (acres)
Cropland	125,953	117,551 a/	-8,402
Rangeland	64,574	71,491 a/	+6,917
Forestland	1,020	1,052	+ 32
Other	6,673	8,126 b/	+1,453
Total	198,220	198,220	-

a/ Includes 259 acres hayland.
b/ Includes +1,610 acres for wildlife and recreation.

PROJECT BENEFITS

Average annual project benefits are $139,300. Of this, $8,100 will accrue from land treatment measures and $131,700 from structural measures. Individual items are shown in Tables 5 and 6.

Average annual floodwater damage reduction benefits with the project installed will total $24,000. Benefits from reduced floodwater damage to crops and pasture will average $20,200 annually and account for 84 percent of the total floodwater damage reduction benefits. Reduced flooding will achieve benefits of $3,500 to other agricultural properties such as stored feed, fences, buildings, and other farm facilities. Annual average benefits of $300 to roads and bridges will result.

Indirect average annual benefits, such as less interruption of travel for mail, school buses, and milk routes are $2,400.

Reduction of the flood hazard will make possible annual benefits averaging $17,300 from more intensive use of land through improved crop rotations and use of fertilizer.

Local net secondary benefits will average $35,600 annually. Secondary benefits from a national viewpoint were not considered in the economic evaluation.

The following off-project benefits will occur annually: $1,300 in Subwatershed No. 3; $16,400 in Subwatershed No. 2; $5,600 in Subwatershed No. 1; and $36,800 between Subwatershed No. 1 and the Arkansas River.

Benefits of $800 will be realized by incidental beneficial use of stored water. Incidental ground water recharge benefits will be $46,600. Incidental benefits were not claimed toward project justification.

COMPARISON OF BENEFITS AND COSTS

Average annual cost of structural measures including installation, operation, maintenance, and administration is $89,600. When the project is completely installed, the structural measures are expected to produce average annual benefits (excluding local secondary benefits) of $96,100. The benefit-cost ratio without including local secondary benefits is 1.1 to 1. With local secondary benefits of $35,600 included, the project benefit-cost ratio is 1.5 to 1. (See Table 6)

PROJECT INSTALLATION

Works of improvement to be installed by the district are proposed to be completed within a five-year period following the adoption of the watershed plan. This schedule is contingent upon availability of federal funds provided under authority of the Watershed Protection and Flood Prevention Act (P.L. 566, 83d Congress, 68 Stat. 666), as amended.

Land treatment measures will be installed by individual landowners and groups of landowners in cooperation with the Agricultural Stabilization and Conservation Service, Extension Forestry, conservation districts, and the watershed district. Technical assistance for land treatment installation will be provided by Extension Forestry, Soil Conservation Service, and the Kansas Forestry, Fish and Game Commission.

Land treatment measures include 10 detention dams that are also a part of the works of improvement in the General Plan of the watershed district.23/ Approval of the General Plan has been obtained in accordance with Sections 24-1213

and 24-1214 of the Kansas Watershed District Act, as amended, from the Chief Engineer of the Division of Water Resources, State Board of Agriculture. The General Plan has been adopted by Wet Walnut Creek Watershed Joint District No. 58. This process, along with requirements of the Chief Engineer, are assurances that the 10 detention dams will be installed essentially as planned. Technical assistance for the detention dams will be provided by the Service and the watershed district.

The Extension Service will assist in carrying out the educational phase of the program through the preparation of general information in cooperation with the conservation districts. The Farmers Home Administration's Soil and Water Loan Program will be available to eligible farmers in the area. The County Agricultural Stabilization and Conservation Committees will cooperate with governing bodies of the conservation districts to accelerate assistance for those practices which will accomplish the conservation objectives.

The watershed district will obtain all land rights, including legal services, needed for installation of the three floodwater retarding structures. The watershed district has the power of eminent domain to obtain land rights for public improvements and has agreed to use such authority when needed.

The watershed district will make arrangements for abandonment, moving, or modification of roads, pipelines, communication lines, or other public utilities.

Land rights will be secured in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. Land rights maps for each structure have been furnished to the sponsors.

The watershed district, as a part of their project administration, will provide written notice, application forms, and advisory services to any displaced person or farm operation; assist in filing applications; review and take action on applications for relocation assistance and displacement grievances; and make relocation payments. The Service will assist the district in carrying out its responsibility.

Decent, safe, and sanitary replacement housing, if needed, will be made available prior to the construction of measures causing such displacements. All displaced persons will be given at least 90 days advance notice to vacate.

Engineering for the three floodwater retarding structures will be provided by the Service. Technical assistance will be provided by the Kansas Forestry, Fish and Game Commission for installation of wildlife measures.

The watershed district will contract for construction of the three floodwater retarding structures.

Construction inspection of the three floodwater retarding structures will be provided by the Service. Sponsors will make contributions toward construction inspection in accordance with their needs.

Construction can be started when necessary land treatment has been completed, necessary land rights have been obtained, P.L. 566 funds are available, and sponsoring organizations have complied with state laws relating to approval of construction plans.

FINANCING PROJECT INSTALLATION

Land treatment measures will be financed by landowners and operators with partial cost sharing through the watershed district and/or state and federal programs in effect at the time of installation. Technical assistance will be provided by the Service using P.L. 46 funds and supplemented by accelerated assistance using P.L. 566 funds. Installation costs of forestry land treatment and fire control measures will be borne by individual landowners, rural fire districts, and other federal programs. The cost of accelerated technical forestry assistance will be borne by P.L. 566 and the Kansas State and Extension Forester. Technical assistance for the fire control measures will be financed by the Kansas State and Extension Forester through the Fire Control Program.

Wet Walnut Creek Watershed Joint District No. 58 has the necessary authority and power to finance and to accept contributions, levy taxes, make assessments against land specially benefited, issue bonds, and exercise the right of eminent domain.

Expenses of organizing the watershed district have been paid and current general expenses are being met by an annual ad valorem tax levy.

All local costs to be financed by the sponsors will be paid from funds currently on hand and budgeted for the purpose, funds that will be collected through taxes before construction takes place, or through the issuance of general obligation bonds.

Any relocation assistance advisory services costs will be financed by the watershed district through a general tax levy.

P.L. 566 funds for construction will be provided to the local sponsoring organizations through project agreements executed with the Soil Conservation Service.

Prior to entering into agreements that obligate funds of the Service, the Wet Walnut Creek Watershed Joint District No. 58 and the Kansas Forestry, Fish and Game Commission will have a financial management system for control, accountability, and disclosure of P.L. 566 funds received, and for control and accountability for property and other assets purchased with P.L. 566 funds.

Program income earned during the grant period will be reported on the sponsor's request for advance or reimbursement from the Service.

Federal technical assistance, engineering services, project administration, and funds for construction are contingent upon appropriations for these purposes.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land treatment measures will be maintained by landowners and operators of farms on which the measures are installed under agreements with the conservation districts. Conservation district representatives will make periodic inspections of land treatment measures to encourage landowners to perform needed maintenance.

The Wet Walnut Creek Watershed District is responsible for operation and maintenance of the 10 detention dams. The district will enter into agreements with the landowners who will perform maintenance as needed.

Technical assistance to landowners and rural fire districts for operating and maintaining forestry and fire control measures beyond the installation period will be provided by the Kansas State and Extension Forester in cooperation with the Forest Service under going programs.

An agreement providing for operation and maintenance of structural measures will be executed by the local sponsoring organizations before federal construction funds are made available.

The three floodwater retarding structures will be operated and maintained by the watershed district. The estimated average annual costs are $2,900. Maintenance will be accomplished

through hired or contributed labor and equipment and funds will be obtained from an annual tax levy.

The Wet Walnut Creek Watershed District will assume the responsibility for passing natural streamflow and managing low-flow releases from the three floodwater retarding structures.

A vegetative measure (associated with structural measures) establishment period is granted. During this period the State Conservationist may approve P.L. 566 cost sharing for additional work that is required to obtain adequate vegetative cover. This period is to terminate when adequate vegetative cover is obtained or two growing seasons have elapsed after initial installation of vegetative work, whichever occurs first. Operation and maintenance responsibility rests with the sponsors during the establishment period, as it does during the remainder of the project life.

Maintenance work for structures and wildlife mitigation measures will be carried out when needed. Kinds of maintenance expected rather frequently are repairs to fences, clearing of debris, etc. Repairs to major construction items such as dams and spillways are expected very infrequently. Technical assistance available through the Soil Conservation Service will be utilized.

Prescribed tree and shrub plantings should be maintained at a 75 percent survival rate for the first 5 years, and thereafter managed to allow for desirable natural growth and reproduction during the life of the project. Mowing, haying, burning, and livestock grazing will be permitted only when deemed compatible with wildlife uses.

All structural measures will be inspected annually, after unusually severe floods, and after any other unusual condition that might adversely affect their operation, maintenance, or safety. The Soil Conservation Service and local representatives responsible for operation and maintenance will make inspections jointly for a three-year period following completion of construction. Thereafter, annual inspections will be made for the life of the structures by the sponsors.

Items of inspection will include, but not be limited to: the principal spillway and its appurtenances, emergency

spillway, earth fill, vegetative cover of the earth fill and emergency spillway, fences installed as a part of the structural measures, and wildlife mitigation measures. Records of inspection will be maintained by the watershed district. Provisions will be made for access to inspect the structures at any time.

Sediment pools will be checked regularly during spring and summer months and measures taken to control mosquito breeding.

If public access for recreation is permitted at any site, the sponsoring local organizations will require or provide sanitary facilities necessary to meet State Department of Health and Environment Standards.

The operation and maintenance agreement will include specific provisions for retention and disposal of property acquired or improved with P.L. 566 financial assistance.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Wet Walnut Creek Subwatershed No. 5, Kansas

Installation Cost Item	Unit	Number	Estimated Cost Dollars[a/]						
			P. L. 566 Funds			Other			
		Non-Fed. Land	Non-Federal Land		Total	Non-Federal Land		Total	Total
			SCS[c/]	FS[c/]		SCS[c/]	FS[c/]		
LAND TREATMENT[b/]									
Land Areas									
Cropland	Acres to be treated	43,100				948,100		948,100	948,100
Rangeland		16,400				180,400		180,400	180,400
Forestland		200					5,500	5,500	5,500
Individual Practices such as - Fire Control		70,000					7,500	7,500	7,500
Technical Assistance			78,300	4,700	83,000	163,000	3,600[d/]	166,600	249,600
TOTAL LAND TREATMENT			78,300	4,700	83,000	1,291,500	16,600	1,308,100	1,391,100
STRUCTURAL MEASURES									
Construction									
Floodwater Retarding Structures	No.	3	819,300		819,300				819,300
Engineering Services			131,100		131,100				131,100
Relocation Payments			0		0				0
Project Administration									
Construction Inspection			237,600		237,600				237,600
Other			81,900		81,900	23,400		23,400	105,300
Subtotal - Administration			319,500		319,500	23,400		23,400	342,900
Other Costs									
Land Rights						118,400		118,400	118,400
TOTAL STRUCTURAL MEASURES			1,269,900		1,269,900	141,800		141,800	1,411,700
TOTAL PROJECT			1,348,200	4,700	1,352,900	1,433,300	16,600	1,449,900	2,802,800

a/ Price base 1974.
b/ Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed, and dollar amounts apply to total land areas, not just to adequately treated areas.
c/ Federal agency responsible for assisting in installation of works of improvement.
d/ Includes $3,300 contributed through going programs.

September 1975

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT

Wet Walnut Creek Subwatershed No. 5, Kansas

Measures	Unit	Applied to Date	Total Cost (Dollars)[a/]
LAND TREATMENT			
Soil Conservation Service			
Conservation Cropping System	Ac.	83,721	633,800
Crop Residue Management	Ac.	81,021	743,800
Contour Farming	Ac.	56,292	370,500
Proper Grazing Use	Ac.	43,407	63,800
Range Seeding	Ac.	3,405	78,100
Grassed Waterway	Ac.	184	30,100
Diversion	Ft.	70,000	7,500
Terrace	Mi.	1,441	509,900
Farm Pond	No.	116	168,400
Irrigation Systems	Ac.	1,813	240,400
Grade Stabilization Structure	No.	3	7,900
Floodwater Retarding Structure	No.	-	-
Subtotal SCS			2,854,200
Forest Service			
Tree and Shrub Planting	Ac.	356	19,900
Fire Control	Ac.	42,930[b/]	37,500
Subtotal FS			57,400
TOTAL			2,911,600

a/ Price base 1974
b/ These acres are included in Table 1 as needing further treatment.

September 1975

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Wet Walnut Creek Subwatershed No. 5, Kansas

(Dollars) a/

Item	Installation Cost P. L. 566 Funds			Installation Cost-Other Funds		Total Installation Costs
	Construction	Engineering	Total P.L.566	Land Rights	Total Other	
Floodwater Retarding Structure						
No. 51	382,900	61,300	444,200	57,300 b/	57,300	501,500
No. 52	286,300	45,800	332,100	40,100	40,100	372,200
No. 53	150,100	24,000	174,100	21,000	21,000	195,100
Subtotal - FRS	819,300	131,100	950,400	118,400	118,400	1,068,800
Project Administration			319,500		23,400	342,900
GRAND TOTAL	819,300	131,100	1,269,900	118,400	141,800	1,411,700

a/ Price base 1974

b/ Includes $5,000 for road modification

September 1975

TABLE 3 - STRUCTURE DATA
FLOODWATER RETARDING STRUCTURES

Wet Walnut Creek Subwatershed No. 5, Kansas

ITEM	UNIT	STRUCTURE NO. 51	52	53	TOTAL
Class of Structure		b	b	b	xxx
Drainage Area	Sq. Mi.	104.9[a]	30.00	8.40	97.2
Controlled	Sq. Mi.	--	--	--	--
Curve No. (1-day) (AMC II)		64	68	73	xxx
Tc	Hours	11.1	6.5	2.8	xxx
Elevation Top of Dam	Feet	2,717.3	2,540.0	2,268.0	xxx
Elevation Crest Emergency Spillway	Feet	2,709.8	2,533.6	2,262.8	xxx
Elevation Crest Low Stage Inlet	Feet	2,690.8	2,513.4	2,251.2	xxx
Maximum Height of Dam	Feet	49.5	46.2	29.3	xxx
Volume of Fill	Cu. Yds.	319,000	289,600	143,800	752,400
Total Capacity	Ac. Ft.	6,178	3,232	1,519	10,929
Sediment Submerged	Ac. Ft.	815	288	215	1,318
Sediment Aerated	Ac. Ft.	32	16	5	52
Beneficial Use (Recreation)	Ac. Ft.	--	--	--	--
Retarding	Ac. Ft.	5,331	2,928	1,299	9,558
Surface Area					
Sediment Pool	Acres	122	52	55	229
Beneficial Use Pool (Recreation)	Acres	--	--	--	--
Retarding Pool	Acres	456	295	186	937
Principal Spillway					
Rainfall Volume (areal) (1-day)	Inches	5.5	5.7	6.0	xxx
Rainfall Volume (areal) (10-day)	Inches	9.2	9.4	9.8	xxx
Runoff Volume (10-day)	Inches	1.64	2.30	3.98	xxx
Capacity of Low Stage (Max.)	c.f.s.	256.4	173.8	38.8	xxx
Frequency Operation - Emrg. Sply.	% Chance	0.4	0.7	1	xxx
Size of Conduit	Dim.	42"	36"	24"	xxx
Emergency Spillway					
Rainfall Volume (ESH) (areal)	Inches	6.7	6.3	7.4	xxx
Runoff Volume (ESH)	Inches	2.77	2.87	4.61	xxx
Type'		Veg.	Veg.	Veg.	xxx
Bottom Width	Feet	500	700	400	xxx
Velocity of Flow (V_e)[b]	Ft./Sec.	6.1	5.0	7.4	xxx
Slope of Exit Channel	Ft./Ft.	.029	.030	.032	xxx
Maximum Water Surface Elevation	Feet	2,712.7	2,536.0	2,265.3	xxx
Freeboard					
Rainfall Volume (FH) (areal)	Inches	12.1	11.4	13.3	xxx
Runoff Volume (FH)	Inches	7.24	7.21	10.14	xxx
Maximum Water Surface Elevation	Feet	2,717.3	2,539.8	2,268.0	xxx
Capacity Equivalents					
Sediment Volume	Inches	0.27	0.19	0.49	xxx
Retarding Volume	Inches	1.70	1.83	2.90	xxx
Other	Inches	--	--	--	--

a/ Includes 46.1 square miles of non-contributing drainage area.

b/ Maximum during passage of hydrograph.

September 1975

TABLE 4 - ANNUAL COST

Wet Walnut Creek Subwatershed No. 5, Kansas

(Dollars)[a/]

Evaluation Unit	Amortization of Installation Costs[b/]	Operation and Maintenance Costs	Total
3 Floodwater Retarding Structures	65,600	2,900	68,500
Project Administration	21,100		21,100
GRAND TOTAL	86,700	2,900	89,600

a/ Price base 1974

b/ 100 years at 6 1/8 percent interest

September 1975

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Wet Walnut Creek Subwatershed No. 5, Kansas

(Dollars)a/

Item	Estimated Average Annual Damage		Total Damage Reduction Benefits
	Without Project	With Project	
Floodwater			
Crop and Pasture	32,100	11,900	20,200
Other Agricultural	4,100	600	3,500
Non-agricultural			
Road and Bridge	400	100	300
Subtotal	36,600	12,600	24,000
Sediment			
Channel Deposition	2,100	1,700	400
Indirect	3,700	1,300	2,400
TOTAL ON PROJECT	42,400	15,600	26,800
Floodwater			
Crop and Pasture	xxx	xxx	14,400
Other Agricultural	xxx	xxx	2,900
Non-agricultural			
Road and Bridge	xxx	xxx	1,400
Railroad	xxx	xxx	400
Urban	xxx	xxx	36,100
Subtotal			55,200
Sediment			
Channel Deposition	xxx	xxx	200
Erosion			
Flood Plain Scour	xxx	xxx	2,500
Indirect	xxx	xxx	2,200
TOTAL OFF PROJECT	xxx	xxx	60,100
TOTAL			86,900

a/ Price base: Agricultural = current normalized (WRC - October 1974): all other = 1974

December 1975

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Wet Walnut Creek Subwatershed No. 5, Kansas

(Dollars)a/

Evaluation Unit	Average Annual Benefits a/			Total	Average Annual Costc/	Benefit Cost Ratio
	Damage Reductionb/	More Intensive Land Use	Secondary			
3 Floodwater Retarding Structures	78,800	17,300	35,600	131,700	68,500	1.9:1
Project Administration					21,100	
GRAND TOTAL	78,800	17,300	35,600	131,700	89,600	1.5:1

a/ Price base: Agricultural current normalized (WRC - October 1974); all other 1974
b/ In addition it is estimated that land treatment measures will provide flood damage reduction benefits of $8,100 annually, including $5,100 from detention structures
c/ From Table 4

September 1975

INVESTIGATIONS AND ANALYSIS

General

A joint study of the Upper Arkansas Basin by the Soil Conservation Service, Forest Service, Economic Research Service, and the Kansas Water Resources Board was started May 4, 1965. Wet Walnut Creek was studied as an example of large watershed potential in western Kansas. Stream and valley cross sections were surveyed by the Kansas Water Resources Board in five mainstem reaches from Heizer to Ness City and on three reaches of the North and South Forks above Ness City. Hydraulic computations were made by Cook, Flatt and Strobel, Consulting Engineers, Topeka, Kansas.

The Kansas Watershed Review Committee assigned a priority for planning on July 31, 1967. A groundwater recharge study was started in the Wet Walnut Basin as a cooperative venture of the Kansas Water Resources Board, the U.S. Geological Survey, and the Wet Walnut Creek Watershed District during the summer of 1968. The State Conservation Commission negotiated and funded contracts for structure site topographic maps of the Public Law 566 sites. Structures in the east half of the watershed district were surveyed by Evans, Bierly, and Hutchison, Consulting Engineers, Great Bend, Kansas; and structures in the west half of the watershed district were surveyed by George McKee, Jr., Consulting Engineer of Colby, Kansas. All other engineering, geologic, hydrologic, and economic investigations were conducted by the Soil Conservation Service.

A forestry work plan was developed by the State Extension Forester, Kansas State University, Manhattan, Kansas, and the Forest Service, U.S.D.A. Information for this plan was gathered from aerial photography of the watershed and a field examination of hydrologic conditions of woodlands. Estimates were made of land treatment measures needed to improve hydrologic conditions; these estimates were included in this plan.

A letter report[10/] covering fish and wildlife resources and recommending measures to offset losses and enhance wildlife habitat was supplied by the Fish and Wildlife Service, U.S. Department of the Interior. The Kansas Forestry, Fish and Game Commission concurred with this report.

The Kansas Water Resources Board and State Conservation Commission provided assistance in drafting the watershed plans and environmental impact statement.

Hydrology and Hydraulics

The five Wet Walnut Watersheds were treated as a hydrologic unit and broken down into 21 reaches. Each reach was evaluated for its present soil cover condition and for its future condition with planned land treatment and cover measures.

A standard procedure[19/] was used to find the relationship between rainfall and runoff with special consideration given to flat pot-holed areas and areas treated with level storage type terraces. A factor of 2.3 was used to convert the annual flood plotting positions to partial duration plotting positions. The relationship between rainfall frequency and runoff volume was calculated for the actual range of hydrologic curve numbers.

Field surveys of the valley and road and bridge cross sections were made. Sufficient readings were taken to define the topography along each section, to locate all crop boundaries and changes in roughness, to locate all roads, fences and other objects along the sections, and to define the shape of the channel detail. The types of road surfaces and bridges were indicated on each road cross section.

The step method was used in defining the hydraulics of the flood plain. A range of discharges from below nondamage flow to above 100-year flood frequency was considered. Flood plain profiles were plotted showing the channel bottom, bank line, and at least five discharges. A semi-controlled, screened aerial mosaic map of the flood plain was developed for each reach.

The relationship between discharge and area of flood plain inundation was based on 73 valley and channel cross sections in eight detailed evaluation reaches. These cross sections were vertically related to mean sea level, and horizontally related by using aerial photographs. The width of flooding at each cross section and the distance between cross sections were used to compute the area flooded in each reach by depth increments. These area data were then combined to determine totals for each evaluation reach.

Similarly, road and bridge cross sections were used to compute lengths of roads inundated by various flood depths.

Frequency discharge relationships were developed for each reach using the SCS TR- 20 computer program with service provided by the Central Technical Unit, Hyattsville, Maryland. Four uniform storms were routed to define discharge frequency curves for present conditions, future conditions with land treatment, future conditions with land treatment and various percentages of control by structures, and future conditions with land treatment and the proposed system of structures. These routings gave the discharge frequency relationship for each evaluation reach under present conditions and for various levels of control including that offered by the proposed plan. Routings were developed for historical storms, September 1959 and May-June 1967, and high water marks were plotted on water surface profiles and peaks determined.

Release rates for floodwater retarding structures were selected according to downstream channel capacities, routing losses, and desired reservoir drawdown times. Single stage release rates for all structures are shown in Table 3, (see "Capacity of Low Stage (Max.)"). Combined maximum release rates will not exceed channel capacities.

Floodwater storage volumes were determined using mass routing procedures for storm durations of up to 10 days. Storms used in this procedure were taken from U. S. Weather Bureau Technical Paper No. 40.[20] The volumes needed for floodwater storage were computed using 25-, 50-, or 100-year frequency storms, depending on the structure hazard class. Floodwater storages were selected to fit site conditions, with minimum volumes computed in accordance with the National Engineering Handbook.

Emergency spillway requirements were found by routing the storm according to SCS Engineering Memorandum No. 27. Computer services were provided by SCS at Lincoln, Nebraska, and Fort Worth, Texas. Emergency spillways will exceed minimum criteria set by the State of Kansas.

Engineering

Topographic maps of the sites for the floodwater retarding structures were made using a photogrammetric plotter and field

surveys. Aerial photographs were taken from approximately 4,800 feet, and topographic maps were made using a four foot contour interval. Accuracy of plotter work was verified by field surveys of centerline profiles. Using the topographic maps, storage capacities were measured and stage-storage curves were developed. Embankment quantities were calculated from centerline profiles.

An inventory of all man-made features, such as farm buildings, roads, bridges, existing and abandoned oil wells, pipelines, power lines, etc., was made and those affected by structures were located on the topographic maps.

Structure Design and Cost Estimates: Structures were planned with single-stage principal spillways and average release rates of 3.5 csm. Elevations of emergency spillway crests were selected to provide at least a 25-year detention storage.

Storage will be provided for a 100-year accumulation of sediment. The elevations of principal spillway crests of floodwater retarding structures will be at the 100-year sediment accumulation levels.

The freeboard hydrograph was routed through all structures with the maximum elevations at or below the tops of the dams.

Drainage areas for all sites were delineated and measured on USGS 7 1/2 minute quadrangle maps and photographs.

Individual structure cost data are presented in Table 2, and the total cost of all proposed structures is shown in Table 1.

Unit costs, reflecting current bid prices for embankment, principal spillways, riprap, fencing, drains, seeding, clearing, etc., were used to determine the total construction cost of each structure. Contingencies were calculated at 12 percent of the engineer's estimate. Installation services' costs were calculated as a percentage of construction cost.

Geology

A groundwater study was conducted by the SCS from May 25 to July 15, 1967. The results of this study were incorporated into a more intensive study by the USGS for Rush County and summarized in Bulletin No. 17 (1972) of the Kansas Water Resources Board.[17]

The preceding study was used by SCS to make an algebraic account of the present without and future with project average annual water budget for the Wet Walnut basin. The water budget included an accounting of recharge waters available for withdrawal, evapotranspiration losses, return flows, and reduction in discharge. The basin water budget was compiled by subwatersheds.

Economic Investigations

Seven reaches representing 57 percent of the flood plain were evaluated in detail. The additional area was evaluated as related to these reaches. Five subwatersheds were evaluated as a unit then divided into individual reaches. Twelve of the 21 reaches had significant flood damages.

The frequency method[21] was used to find average annual floodwater damages. Data on floodwater damages were collected by personal contacts with farm operators, township and county officials, and local agricultural technicians. Interviews were obtained from at least 46 percent of the landowners and operators of the flood plain area in each evaluation reach; the maximum interview coverage in any one reach was 65 percent. The storms of September 1959 and July 1958 were discussed.

Damages that occurred under present land treatment conditions were computed in each evaluation reach. Damage estimates were made for future land treatment conditions, future land treatment conditions with varying percentages of control by floodwater retarding structures, and future land treatment conditions with the proposed plan. Where more intensive use of land would be possible, benefits were computed under these same conditions. More intensive use was computed on those acres lying within the flood plain delineated by 2.84-year and the 10-year frequency floods.

A composite acre of flood plain use was constructed by measuring the percent of each land use shown on valley cross sections. Average crop yields, adjusted to flood-free conditions by the judgment of farm operators and agricultural technicians were projected to reflect future conditions without the project. Different composite acres and crop yields, which would be possible under more intensive land use, were similarly obtained.

The percent loss from each crop on the composite acre was estimated according to depth, duration, and month of flooding. The damage to the composite acre was weighted using the lower values of crop yields from the scoured areas. The percent loss was used to determine rates of damage on the composite acre (adjusted normalized prices), using the percent of the year's excessive storms occurring in each month,[22] and the weighted value of the composite acre multiplied by total acreage inundated by selected discharges. A curve showing monetary damage versus flood discharge was developed to provide a cost estimate for each storm in the 100-year flood series. A weighted value (current normalized value) was developed and damages updated by a factor.

Interviews were used to determine other agricultural damages from the September 1959 and July 1958 storms. These included loss of livestock, damage to private roads, dikes, and fences, and removal of debris. From rainfall records and high water marks, the discharge of these storms was determined for each evaluation reach. From these data a dollar damage versus discharge curve was developed and applied to the 100-year flood frequency series. These values were updated to current prices.

Road and bridge damages were based on repair or replacement costs obtained from county engineers. Damages to various types of road surfaces were computed as the dollar damage per foot by depth of inundation. Damages to individual bridges were estimated for a range of discharges. Road and bridge damages were then combined in each evaluation reach and dollar damage versus discharge curves were plotted. These curves were then applied to the 100-year flood frequency series. The values were updated using the Engineering News Record Construction Cost Index.

Flood plain scour damages were derived from geologic field data. The number of acres damaged, the severity of damage, and the estimated period and degree of recovery were considered, with and without the proposed project. The economic evaluation was based on the net value of the cropland composite acre. The changes in net income due to scour damage were discounted at an 8 percent interest rate.

Indirect damages include such items as food spoilage from electric power failure; slower rate of weight gain of livestock and extra expense caused by feeding interruption (even though livestock were not in the flood); and additional distances driven by rural mail carriers, school buses, and farmers because of flooded roads. Indirect damages were computed at 10 percent of the agricultural damages and 15 percent of the nonagricultural damages.

Recharge benefits were computed as the increased net value from dry land cropland to irrigated cropland for the number of acres for which water will become available. This value was reduced for increased floodwater damage and discounted for a 10-year lag in accrual.

The damage reduction benefits occurring downstream from Subwatershed No. 1 are fair share benefits accruing to the project from the Great Bend area. This includes 13,100 acres of Wet Walnut flood plain below the watershed and 2,200 acres of flood plain common with the Arkansas River.

Increased flood damages from reduced channel capacity from sediment deposits were computed.

Local secondary benefits were computed following procedures in the EWP Technical Note--Watershed LI-7, February, 1973. Indirect benefits and benefits resulting from a change in consumptive patterns were excluded from consideration in computing secondary benefits.

All structures were individually evaluated. The relative contribution that structural control in each upstream subwatershed made toward reduction of peak discharge was the basis for distribution of evaluation reach benefits.

Costs of land rights were based on the value of cropland and pasture as determined by the watershed directors. These values, slightly higher than the capitalized value of net production, were used for project evaluation. These values agreed on were $300/acre for upland cropland, $750/acre for bottom cropland, and $200/acre for pasture for the floodwater retarding sites. Land costs were based on 100 percent of value for the sediment pool areas, 75 percent of value for the structure and spillway areas, and 50 percent of value for the floodwater retarding areas. The productive capacity retained under future conditions was thereby considered. Full fair market value was used as the basis for the cost of all land purchased for the recreation development.

All monetary benefits were based on current normalized prices approved by the Water Resources Council. Construction costs were based on 1974 construction costs for Kansas P.L. 566 projects. Operation and maintenance costs were computed at 0.35 percent of construction costs for floodwater retarding structures; this percentage method was developed by the SCS and is based on the principle that the relative probability of need for major repairs decreases as the number of structures increases. Federal and local costs for structural measures were amortized at 6 1/8 percent interest rate for a period of 100 years.

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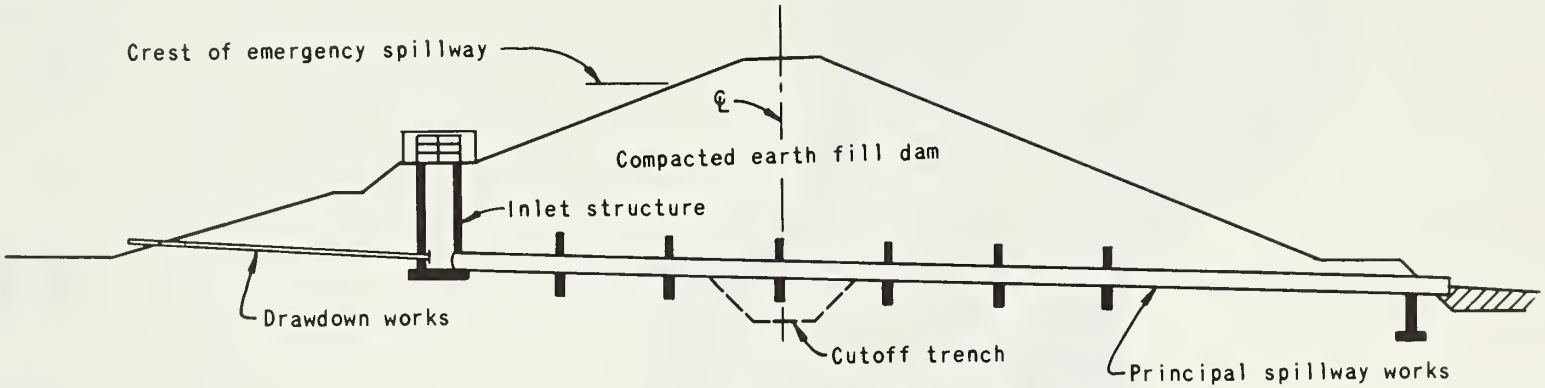
27. Rowlison, Don D., Testing and Assessment of the Archeological Sites in the Proposed Structure Locations Within the Wet Walnut Creek Watershed District of Rush, Ness, and Lane Counties, Kansas, August 1975.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

TYPICAL EARTH DAM WITH PIPE DROP INLET



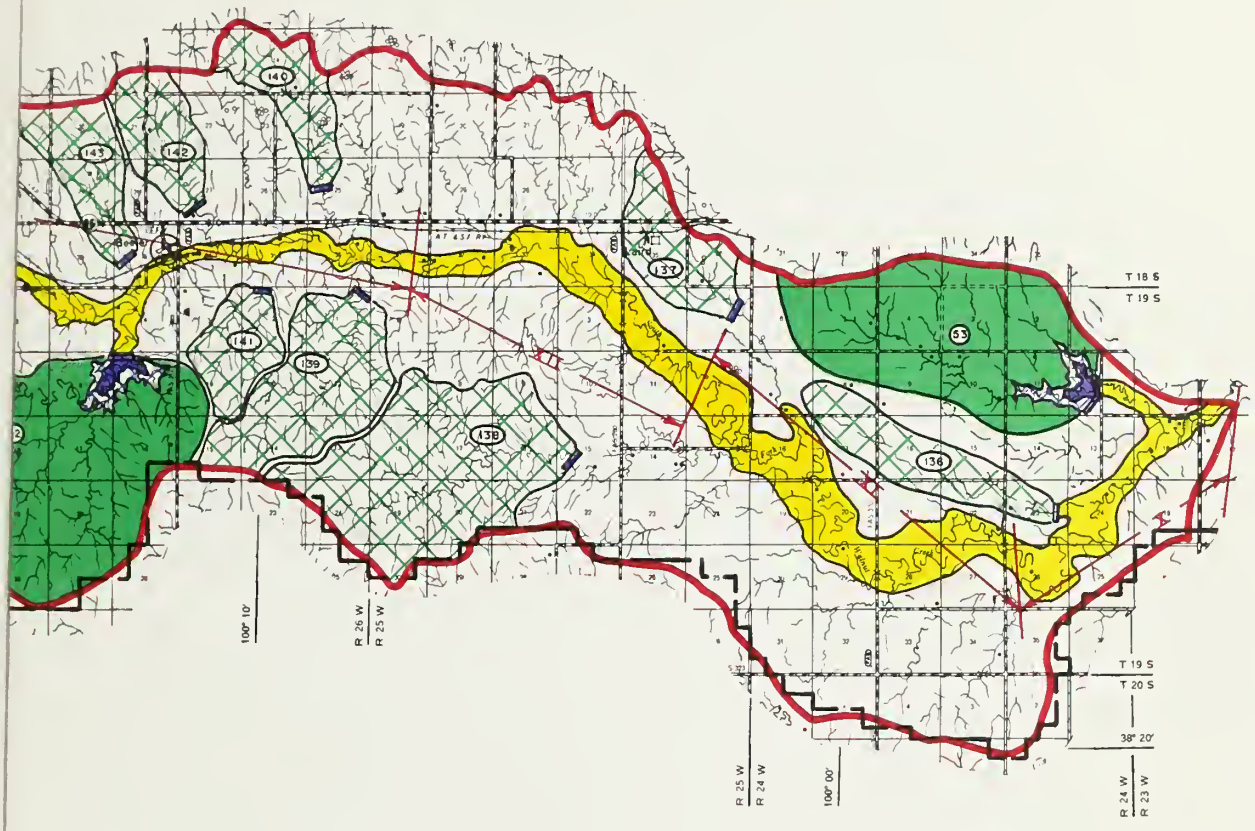
CROSS SECTION OF DAM ON CENTERLINE OF PRINCIPAL SPILLWAY

NOTES:

1. FOR INDIVIDUAL STRUCTURE DATA SEE TABLE 3.
2. EMBANKMENT AND FOUNDATION DESIGN FEATURES NOT SHOWN.

SOIL CONSERVATION SERVICE

EEK WATERSHED
TIES



LEGEND

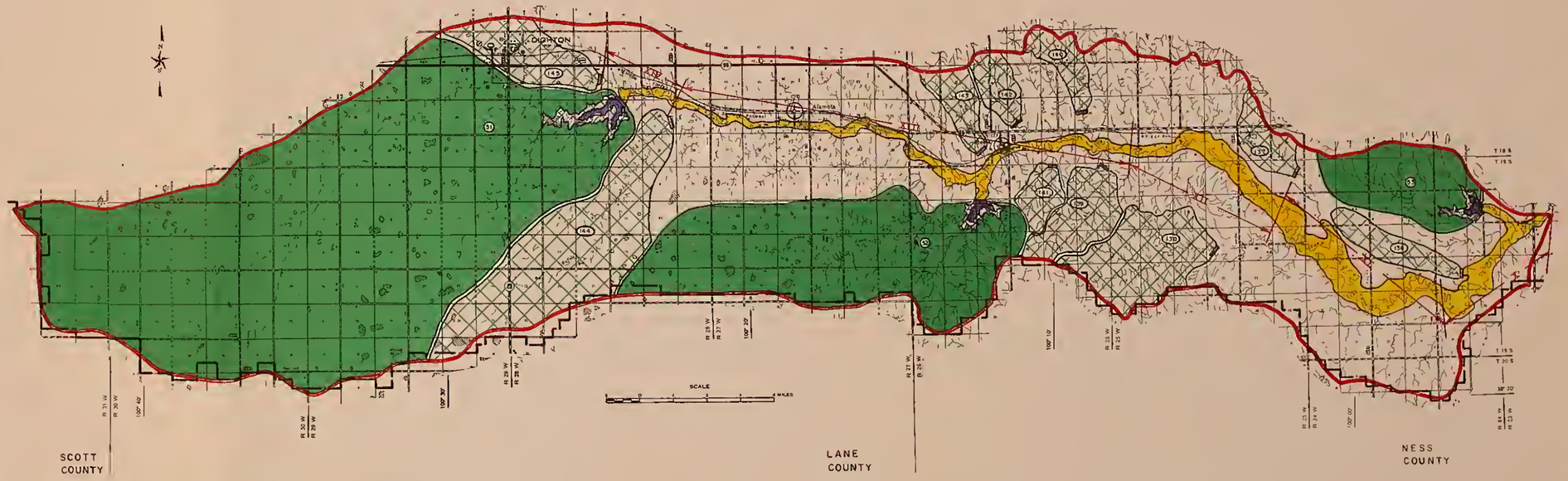
- FLOODWATER RETARDING OR MULTIPLE PURPOSE STRUCTURE
- SEDIMENT STORAGE POOL
- MUTIPURPOSE STORAGE POOL
- FLOODWATER DETENTION POOL
- AREA BENEFITED
- DRAINAGE AREA CONTROLLED BY R. E. A. P. STRUCTURE
- (2) P. L. 566 STRUCTURE NUMBER
- (202) R. E. A. P. STRUCTURE NUMBER

U. S. DEPARTMENT OF AGRICULTURE

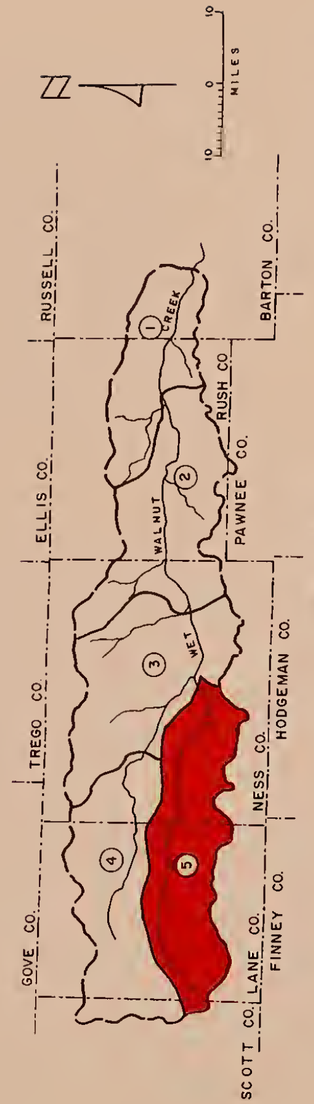
SOIL CONSERVATION SERVICE

PROJECT MAP
SUBWATERSHED NO. (5) WET WALNUT CREEK WATERSHED
NESS, LANE AND SCOTT COUNTIES
KANSAS

KANSAS



WATERSHED PROJECTS LOCATION
WET WALNUT CREEK



LEGEND

PROJECT WATERSHED BOUNDARY

(2) SUB WATERSHED NUMBER

WET WALNUT CREEK WATERSHED BOUNDARY

DRAINAGE AREA IN SQUARE MILES

(51)	58.80	(136)	4.18
(52)	30.00	(137)	2.96
(53)	8.40	(138)	9.20
		(139)	5.67
		(140)	2.46
		(141)	1.90
		(142)	2.30
		(143)	2.68
		(144)	20.80
		(145)	5.36

SOURCE:
INFORMATION FURNISHED BY FIELD TECHNICIANS, EVANS - BIERLY - HUTCHISON ENGINEERS

LEGEND

LEGAL WATERSHED BOUNDARY

NATURAL WATERSHED BOUNDARY

DRAINAGE AREA CONTROLLED BY P.L. 566 STRUCTURE

EVALUATION REACH

LEGEND

FLOODWATER RETARDING OR MULTIPLE PURPOSE STRUCTURE

SEDIMENT STORAGE POOL

MUTIPURPOSE STORAGE POOL

FLOODWATER DETENTION POOL

AREA BENEFITED

DRAINAGE AREA CONTROLLED BY R.E.A.P. STRUCTURE

(2) P.L. 566 STRUCTURE NUMBER

(202) R.E.A.P. STRUCTURE NUMBER